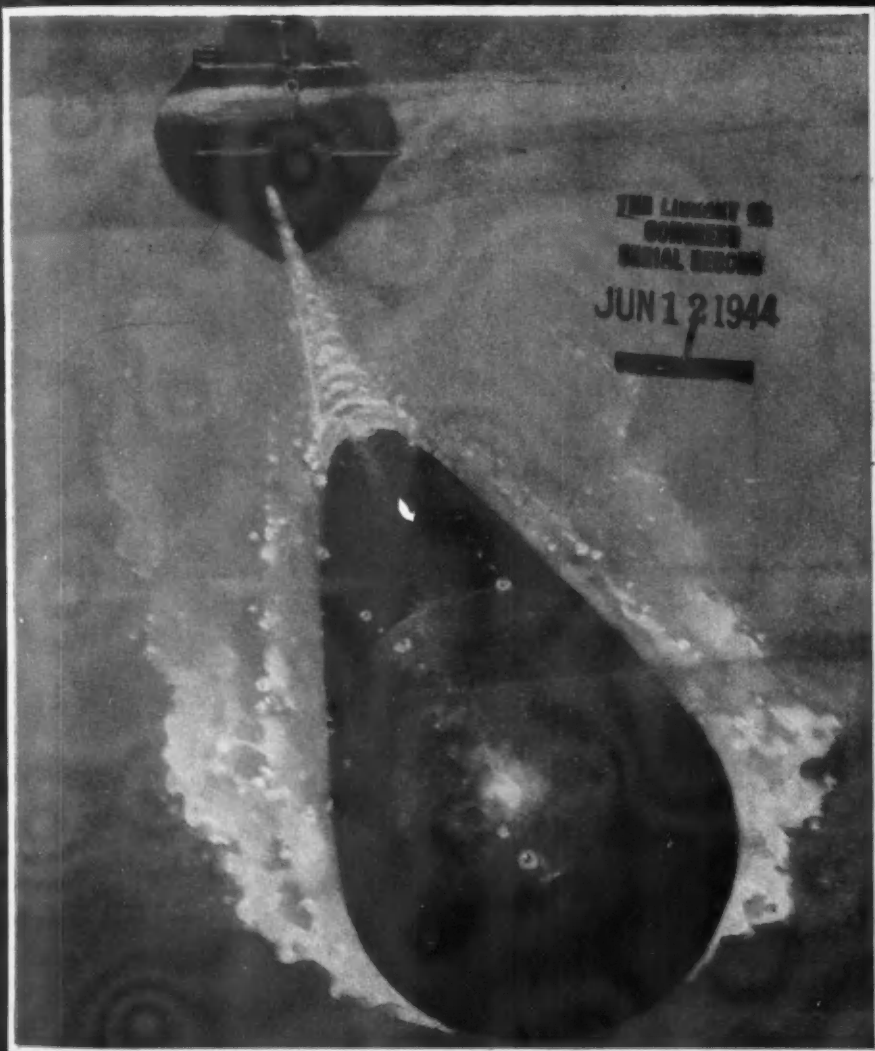


AUTOMOTIVE *and Aviation* INDUSTRIES

JUNE 1, 1944

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Vol. 90

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June 1, 1944

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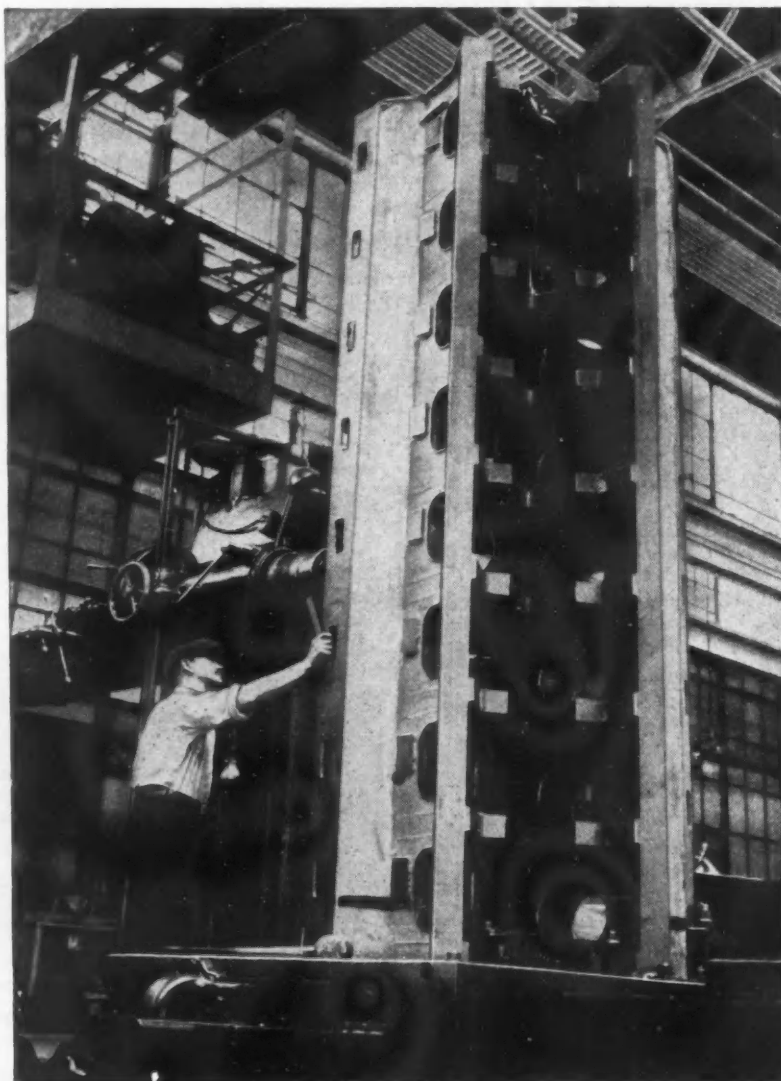
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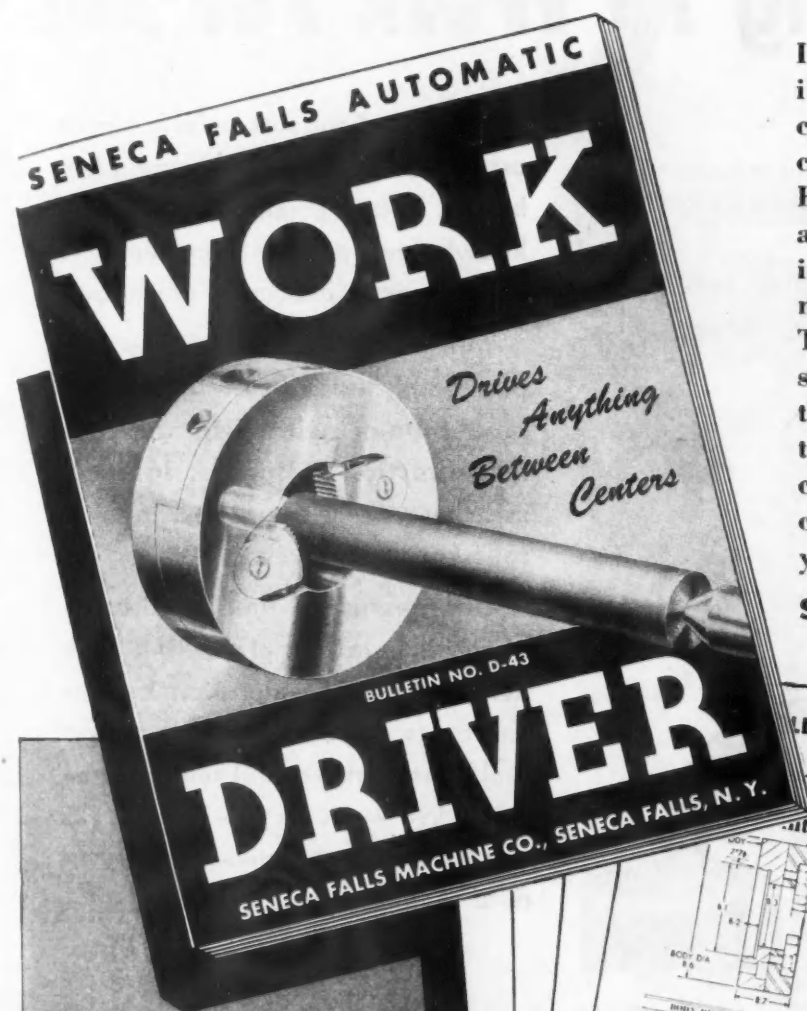
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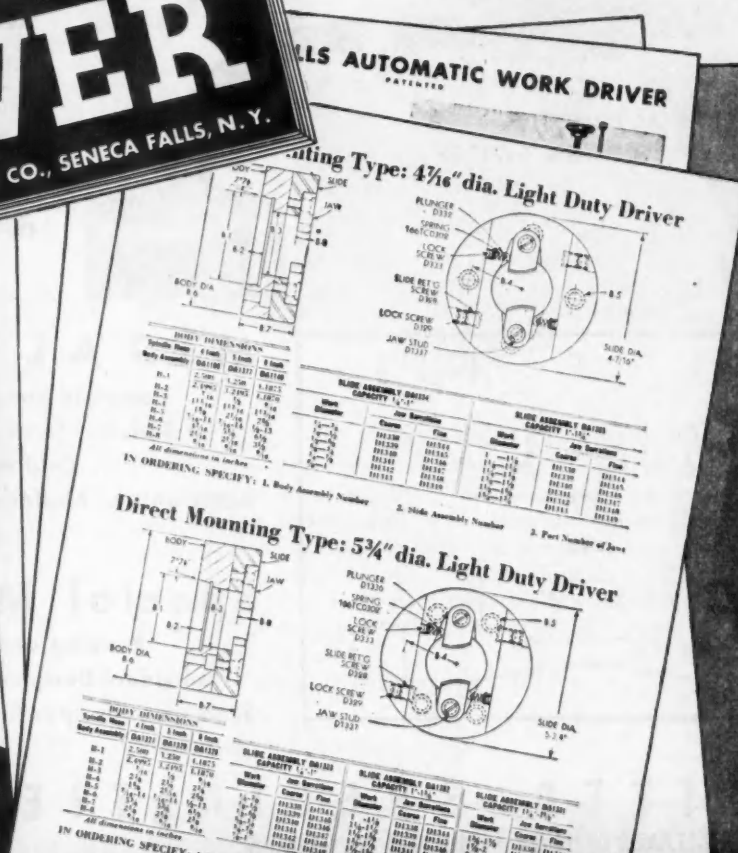
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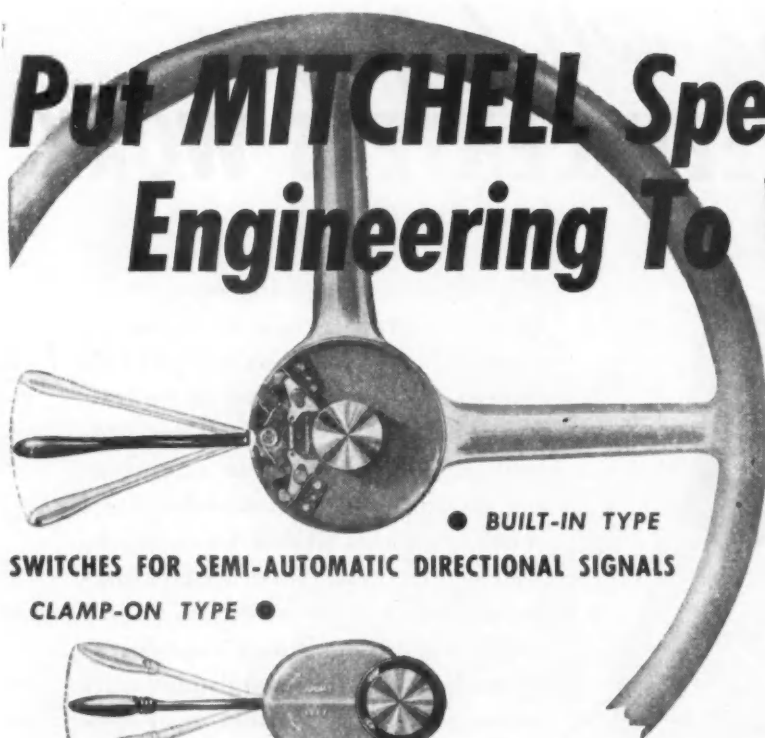
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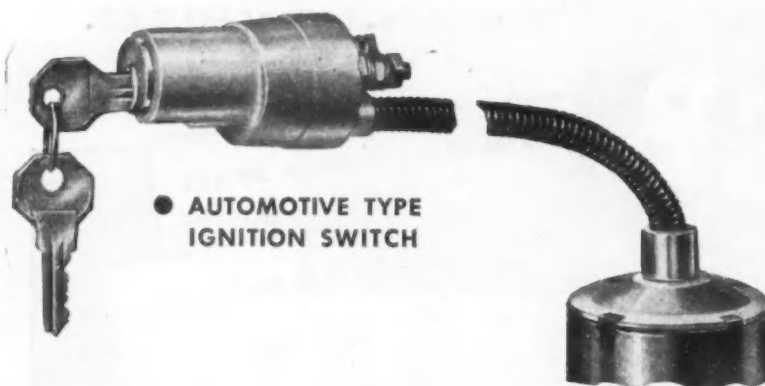
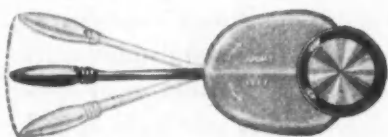
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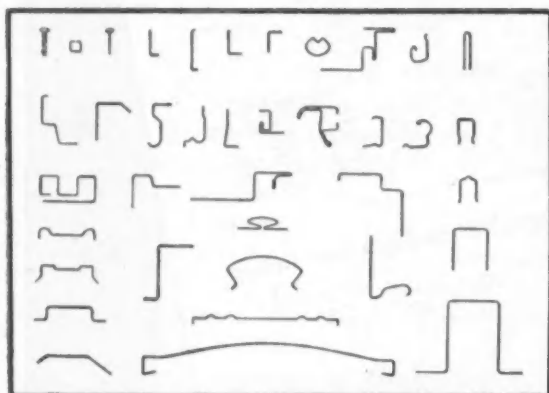


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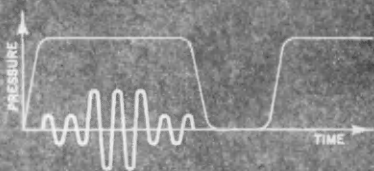
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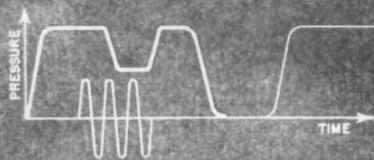
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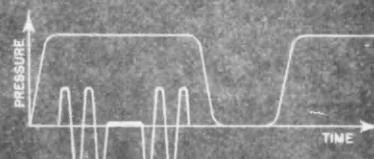
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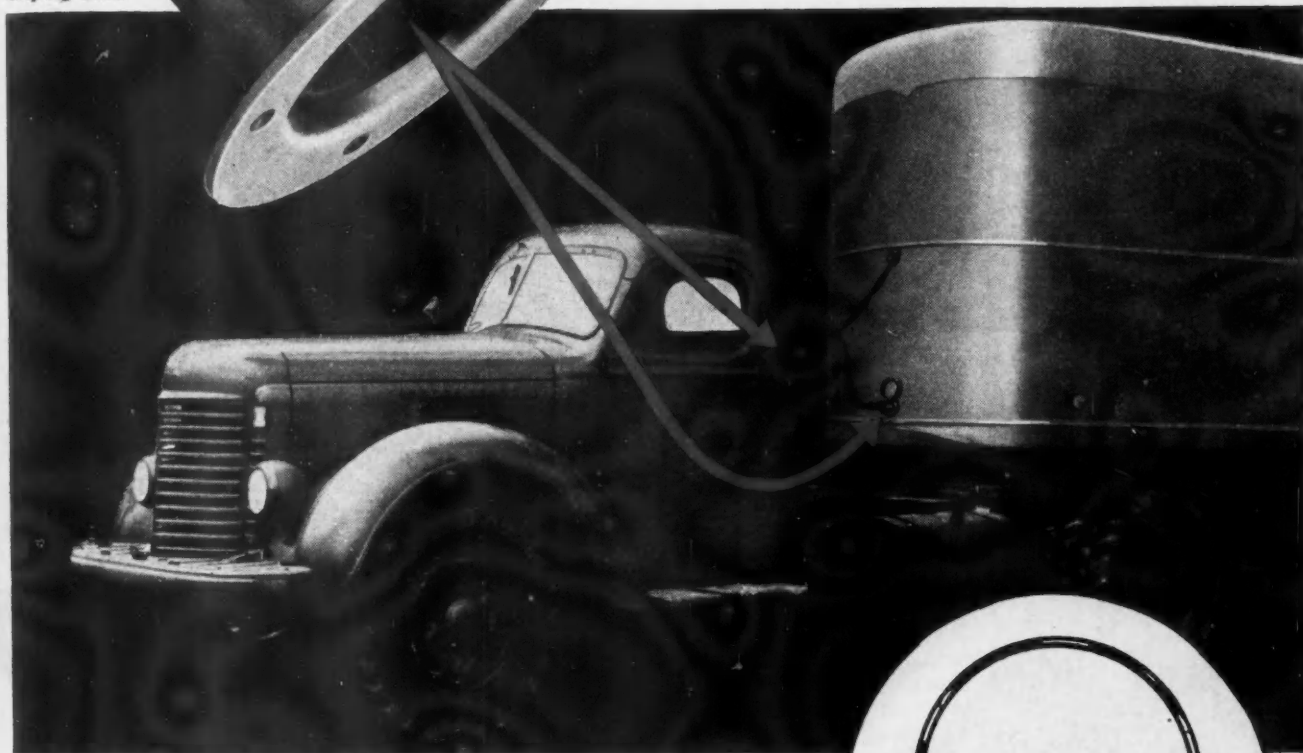
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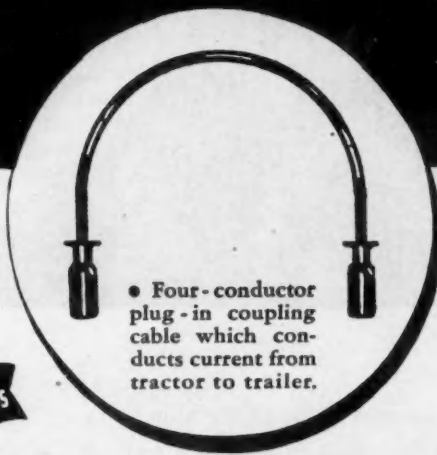
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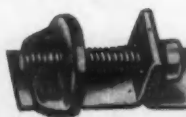
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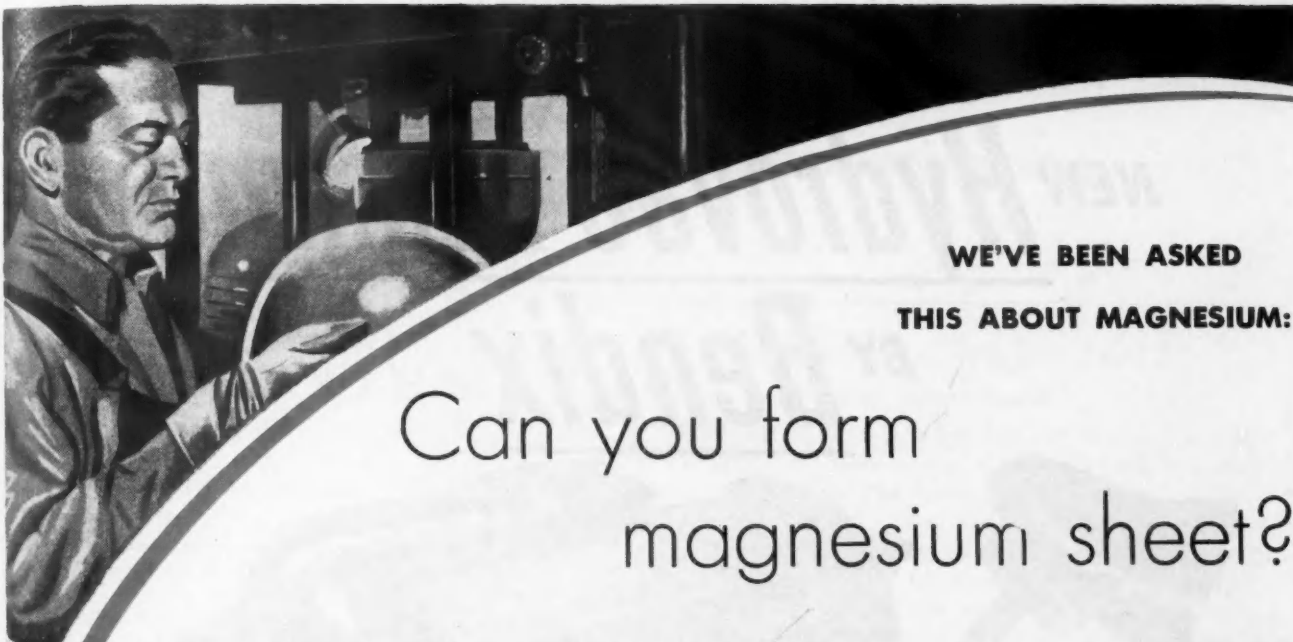
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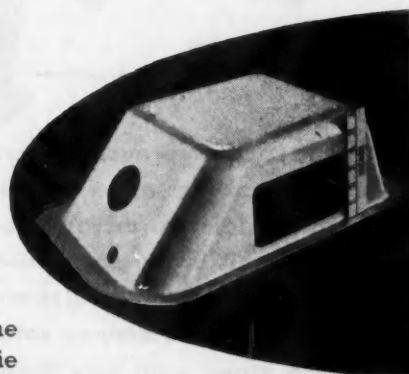
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IN THIS ISSUE

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 90

June 1, 1944

Number 11

Sensible Planning for the Days to Come

17

So many elements enter into planning for the postwar days that any analysis of the problem from any member of a high ranking force in the nation's industrial setup is welcome. This article is well worth the reader's time, full of "meat" and data.

Combating Vibration

22

This is a problem in the design of aircraft that has been the source of many "a headache." Here is an exhaustive study of the problems that have to be met.

Rear-Engined Tatra Car

26

As far back as 1932 this Czecho-Slovakian car created a great deal of interest by virtue of its many unorthodox features. On through the years it continued on its way cutting a new swath in design trends. With the beginning of the present war to now, little has been learned of it, but here is an article that brings you up to date.

Future Highway and Truck Design

28

Much in the change of design and procedure is expected "after the war." We are looking forward to big changes in many things. Particularly is interest high in the field of commercial transport over the roads. Here is an analysis of what may be expected in this most important field.

Compression Properties Of Sheet Metal

36

The presentation of this article should find a most welcome place in the reading time of production men. Written with an authoritative background and well illustrated.

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Free Men or a Tended Herd?

By Dr. Willard H. Dow

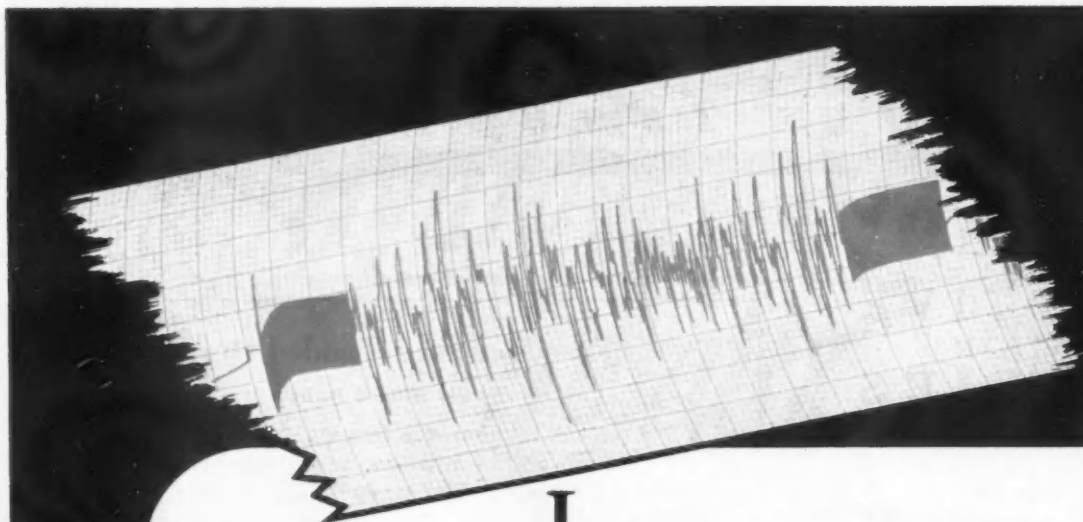
COUNTLESS millions are longing for what they call security and seem willing to pay any price for any package so labeled. The sands of man's belief in himself are running out. Men and women are trying to escape today by dreaming of tomorrow. How many of us are really willing to accept the challenge of individual responsibility and make our own futures? How many of us are watching for a chance to break out of the lock step of thought in which we as a people are now marching and to do a little walking at our own gait? How many of us have the burning passion to step out for freedom?

Our forefathers fought and gained the right to think and act for themselves. The Declaration of Independence was a living, fighting thing and not just a nice resolution casually adopted at a convention. We did not derive our freedom from any government. On the contrary, we set up a government and lodged with it only such small parts of our freedom as we thought necessary for the preservation of a reasonable order. Our wise Fathers were so fearful that even these little trusteeships of freedom might be abused, that they delegated supreme power to no man and to no group of men, in the fervent hope that no government could ever be established as a thing of itself and apart from the people. They did not depend upon a government. The government depended on them.

The utter reversal that has come about in our manner of thinking—a reversal which holds much evil and no good—is being driven in by a parade of authorities through committee rooms, through lecture halls and even through pulpits, solemnly warning us and exhorting us not to be hasty in getting rid of our war-time controls so as not to lapse into another dreadful era of tooth and claw. We are being warned against the dangers of freedom. We are being openly counseled to follow the cultures and even the diets of nations that never knew freedom. In the 'twenties, foreign missions were inspecting us to see how and why we managed so well. Now, in the 'forties, we are being taught that whatever we did in the past as a people was crude and quite wrong and that our future lies in being something other than American.

I do not believe that the United States is a failure. Although we have a lot to learn and, if we keep our balance, we shall always have a lot to learn, I think that what we have to learn from abroad is in the way of what *not* to do and not in the way of what *to* do.

(Turn to page 70, please)

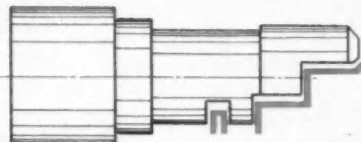


In the sign language of a profilometer, the above chart tells you that the equipment illustrated here produces a *broached surface finish* of 25 to 35 micro-inches. What the profilometer headline does not tell you is that this high grade finish is not a trick or a laboratory experiment, but the results of a routine job tooled up by CINCINNATI Application Engineers.

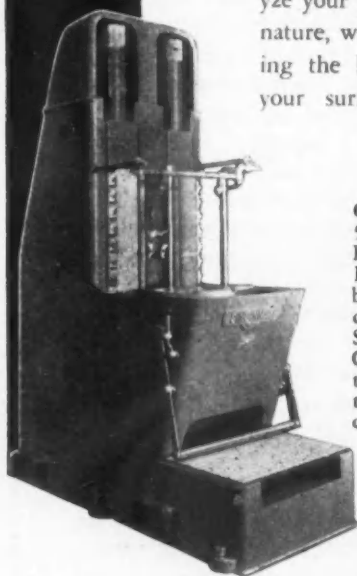
The part is a steel core. Three flats and a bevel are broached in the left-hand station of a CINCINNATI No. 3-48 Duplex Hydro-Broach, while a second operation is handled in the right-hand station. Adequate clamping pressure, through an ingenious spring loaded telescoping lever arrangement, holds the part firmly. Furthermore, proper spacing of the broach inserts aids rapid exit of chips and assures excellent finish.

This job suggests new possibilities of the CINCINNATI Hydro-Broach

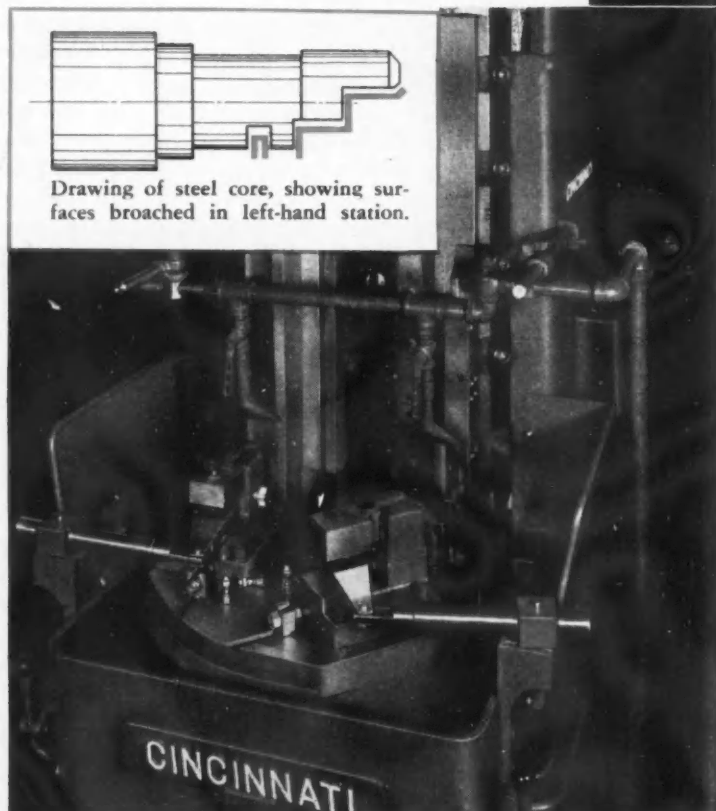
Machine in the field of high quality surface finishing. Our engineers will be glad to analyze your problems of a related nature, with the view of applying the broaching method to your surface finishing work.



Drawing of steel core, showing surfaces broached in left-hand station.



CINCINNATI No. 5-42 Duplex Hydro-Broach Machine. Brief description may be found in the machine tool section of Sweet's Catalog File. Complete specifications may be obtained by writing for catalog No. M-894-2.



THE CINCINNATI MILLING MACHINE CO. CINCINNATI, 9 OHIO, U.S.A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES

Sensible Planning

for the Days to Come

THERE has been much speculation as to the year-to-year volume of business following the war. We cannot know the future, yet we must make some assumptions and lay plans accordingly. The future of business will depend very largely on world and national decisions—next November's election is one example—that are, even now, in the making, but about which we can know very little, and can only hope for the best. In spite of all this uncertainty, it is still the part of wisdom to plan optimistically; provided only that one does not plan recklessly and without a reasonably safe line of retreat in case of need.

The sensible way to approach postwar planning and forecasting is by familiar methods. Postwar planning is no new problem; it is no different, except in degree, from the long-term planning that successful business men are doing continuously. We are, it is true, facing a greater variety of new conditions that makes this planning just now more difficult; but a highly favorable fact is that everyone realizes that conditions following the war will be different.

Each kind of product, each customer group, and each market area has its past history, its characteris-

tics, its war experience, and its postwar prospects. As always, these should be studied by familiar and tested market-research methods. Separately and in addition to this individual-product approach, each large company has its own history and experience through which it has developed an individuality and a composite character that can serve as a guide to its composite or integrated future.

Different lines of product will, of course, have quite different postwar prospects. There is general agreement that consumer's durable goods, such as automobiles and electric refrigerators, will enjoy the most favorable situations. Consequently, there are many different postwar employment problems; and each kind of business has its separate problem.

Much has been written about the necessity for full employment after the war. However much industry and the public generally may desire to avoid the sufferings and losses of extreme unemployment, full employment, in the end, will depend on the confidence of the public and

of industry in the immediate future and their consequent willingness to spend their money. There will be plenty of money to spend; what may be lacking is the willingness and confidence to spend.

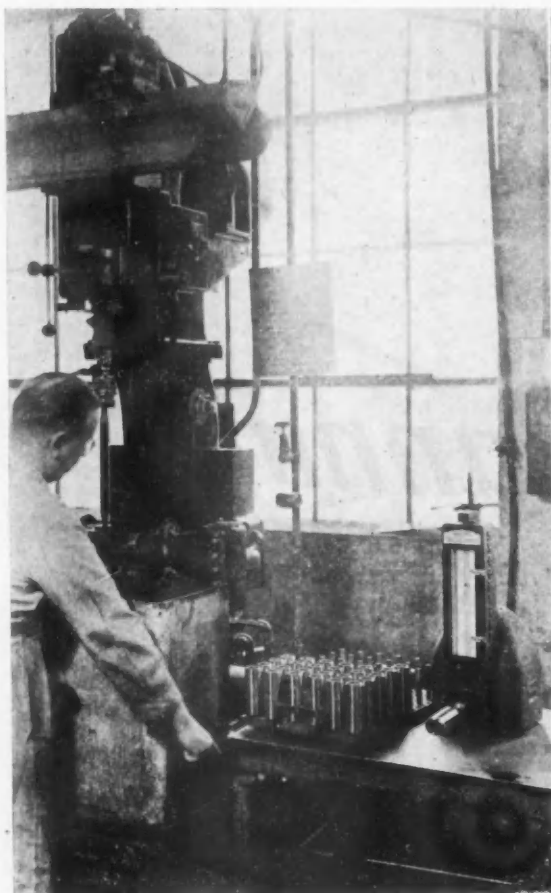
Modern industry is a highly-complex mechanism; jobs are made by the aggregate decisions of business men to expand facilities and by consumers to buy goods. We have never had prosperous times without both capital expenditures and consumer expenditures

(Turn to page 78, please)

By F. D. Newbury

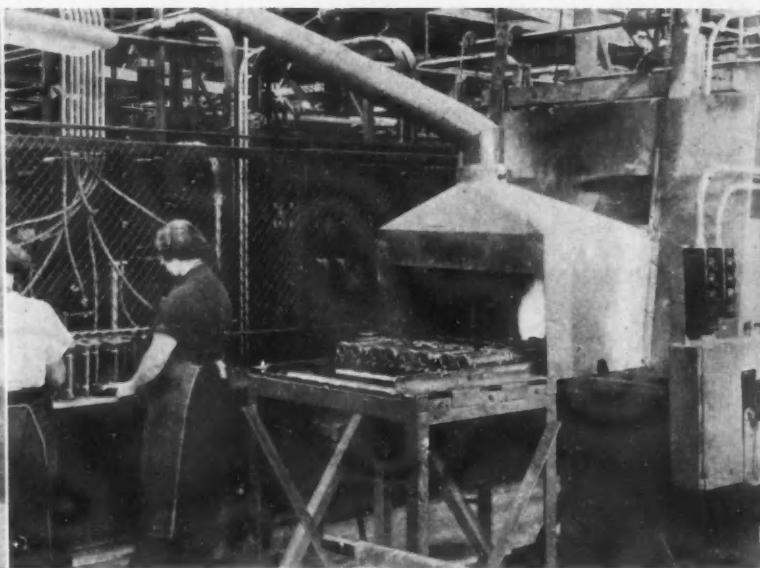
Vice President, Westinghouse
Electric & Manufacturing Co.

This article is from a paper presented at the 1944 Westinghouse Machine Tool Forum.



(Above) This Barnesdril honing machine, fitted with Micromatic honing tools, serves to finish the ground I. D. of aircraft pins to specified micro-inch limits. Sheffield Precisionaire gage at the right checks dimensional accuracy.

(Above right) Close-up of entrance end of one of the unique triple-action brazing furnaces developed by B-N and built by General Electric, for the brazing, quenching, and hardening of fabricated tank track treads. A battery of these furnaces is found in the Ordnance plant.



Burgess Norton Now *Produces* Aviation and

*This is the Ninety-fourth
in the series of monthly
production features*

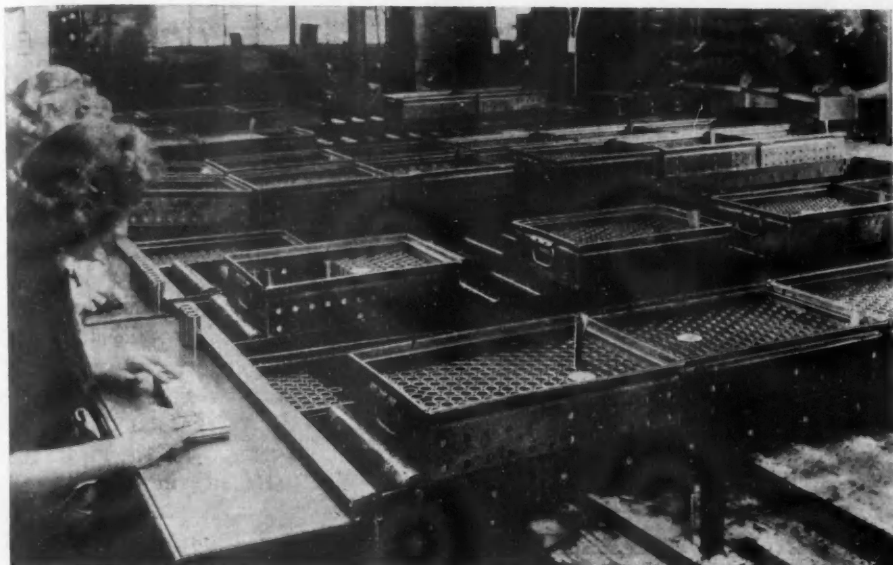
BACKED by a history of some 25 years of specialization as an automotive parts producer, the Burgess-Norton Mfg. Co., Geneva, Ill., under the leadership of C. M. Burgess, claims the distinction of being the largest manufacturer of piston pins in the commercial engine field. Among its regular customers may be listed the roster of automotive industrial, marine, truck, and tractor engine production.

To carry its share of the war program, the company also added aircraft engine piston pins and is producing them in large quantities. While the introduction of the aircraft pins brought new problems of machining and finishing as well as higher levels of quality control, there is no doubt that the experience thus gained will be instrumental in still further improvement of quality of automotive pins in the post-war era.

To the observer it is quite amazing to find that due to differences in engine design as well as to differing tastes on the part of designers, this organization has

in regular production something like 1000 different piston pins. That such variety in form, size, quality, and materials specifications can be produced over one line of equipment in one plant connotes an excellent degree of flexibility in production thinking and planning. It is an obvious reflection on the part of the writer that even a moderate degree of standardization or simplification by the industry could have a salutary effect upon increased productivity and still lower production costs in the peacetime economy.

Although Burgess-Norton has continued its piston pin specialization during the war, the talents of the organization were extended to include the manufacture of tank treads at a time when these were badly needed in enormous quantities. This activity stemmed from the early "defense program" work with Rock Island Arsenal which established the company as an outstanding producer of tank treads. After Pearl Harbor when tank treads were demanded in almost "astronomical" quantities, the management coordinated the efforts of a group of seven companies



(Left) General view of final inspection station where the pins are subjected to visual inspection for surface perfection.

(Below) One of two Wheelabrators in the plant, used for shot-blasting so as to permit identification of soft spots after heat treatment.

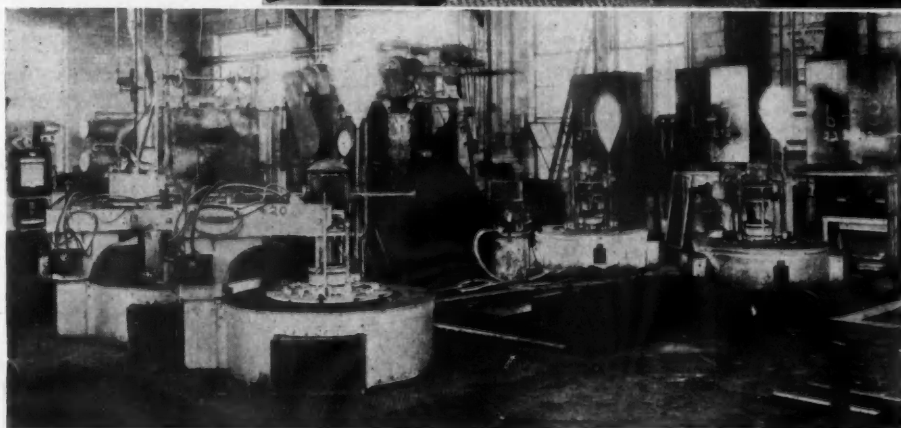
(Bottom of page) Corner of heat treating department showing a battery of pit-type Hevi-Duty furnaces.

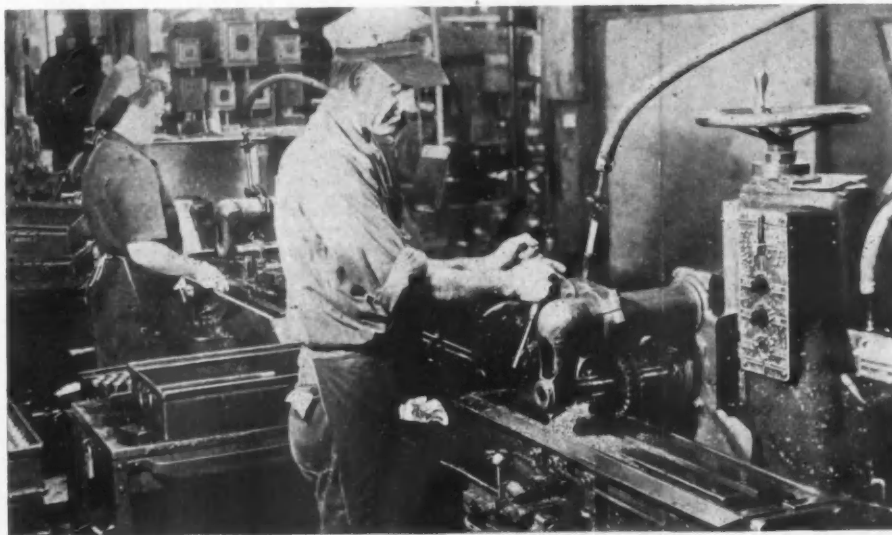
Piston Pins Tank Treads

By Joseph Geschelin

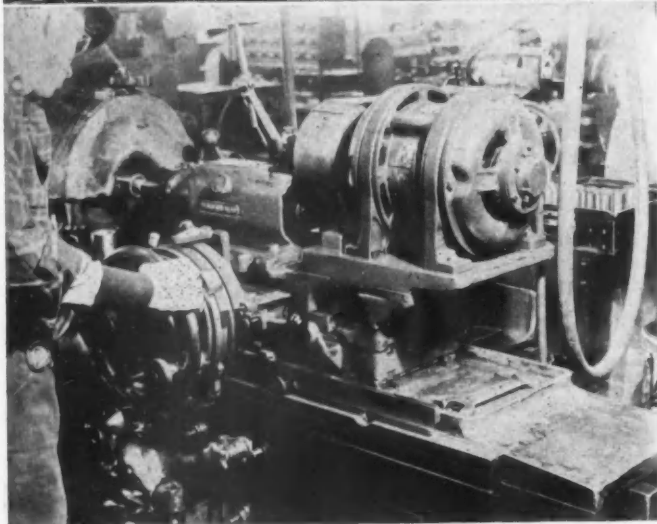
which, under the technical direction of Burgess-Norton, were set up to produce these parts. Early in 1942 when the rubber conservation program was introduced by the War Production Board, Burgess-Norton was ready with the design of an all-steel tread to replace the rubber-molded tread originally employed.

In keeping with this important program, the company also started a new Government-owned plant—Plant 3 in Geneva—for the production of tank treads. Among its technical achievements was the development of a triple-action hydrogen brazing furnace for the automatic brazing of the tread assembly. In this operation the assembly, consisting of the two tubular members fitted in the end plate forgings, is securely brazed at an extremely fast rate,





(Left) Part of a battery of small Sundstrand milling machines handling the variety of milling machine operations—slots, keyways, etc.



(Bottom left) Heald internal grinder in the finishing department is used for finish-grinding the I. D. of aircraft pins.

eliminating the slower hand welding process originally employed. These huge furnaces, equipped with roller-hearth conveyors, extend some 110 feet in length and were built to specifications by the General Electric Co. They are arranged in stages for the brazing, cooling, reheating, and quenching of parts in one continuous cycle. It appears certain that the know-how and specialized equipment in Plant 3 can be turned to many useful purposes after the war and should be effective in extending the scope of operations of this company.

Coming to piston pin production facilities, consider the flexibility required to handle the variety of parts made here. For this purpose, the plant operation has been divided into a number of self-contained departments. First is the machine shop in which the variety of pins are prepared in the "soft" stage. Next is a comprehensive heat treating department, featuring some of the most advanced equipment and metallurgical methods known to the art. And finally there is the finishing department for handling grinding, honing, lapping, etc. Quality control extends to every phase of the operation and is intimately interwoven with the finishing stages as will be described later. Variation in materials, in size, in design detail, and

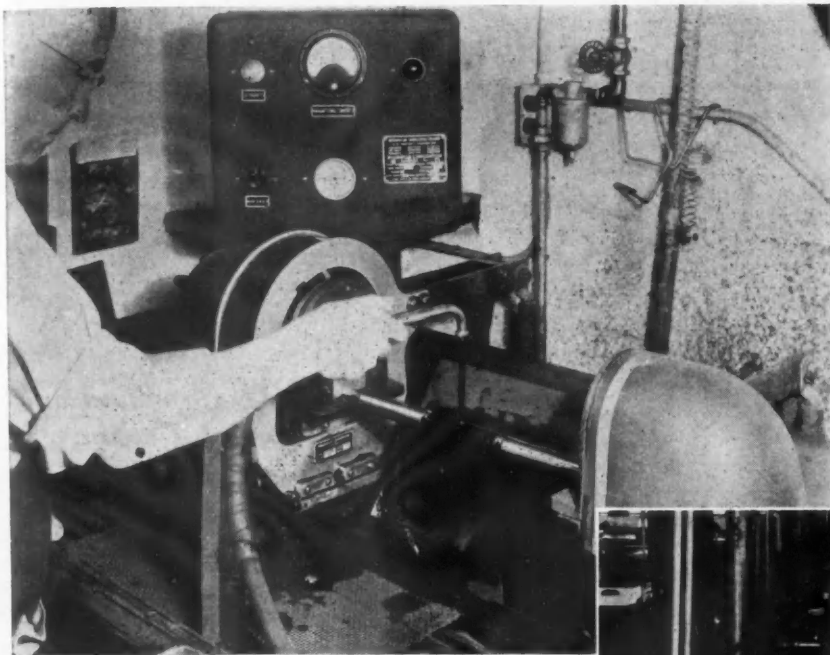
in quantities, play such a major role in the routing of each part as to make it necessary to cover the operation in generalized terms. Nevertheless, there is a common pattern of good methods and quality control that applies to every part.

Versatile Greenlee automatics and the huge Cone automatics predominate in the initial rough machining operation. Some pins, required in large quantities, are produced on bar automatics from either bars or tubular stock. Others, particularly the large pins which are made in smaller runs, are cut to length on saws, and are then drilled to rough size on special Greenlee multiple spindle drilling machines, or special Barnes drill presses fitted with indexing tables.

In addition to equipment for facing, counter-boring, etc., there is a large battery of small Sundstrand mills for handling the variety of slots required on pins of different types. It also may be noted that in the case of some of the larger pins made in small quantity, many of the detail operations, including the finishing of the ID, are done in special drilling machines. An excellent example of this is found in the use of several Barnesdril Hydrams, multiple-spindle drilling machines fitted with the multiple-station indexing tables to facilitate speed.

Following "soft" machining, the pins go to the heat-treating department. Here again variations of size and material specification establish differences in metallurgical treatment with their consequent differences in equipment. Thus, some of the product is case carburized in Hevi-duty electric furnaces of pit type with a gas carburizing atmosphere; others are pack-carburized in Hevi-duty furnaces and Mahr furnaces. Despite the method of treatment, the same general pattern of controlled cycle carburizing, quenching, and drawing is followed throughout. To further complicate the metallurgical picture, some parts which have relatively thin-wall sections are cyanide-hardened to a light case but extremely hard surfaced. This is done in special pots, using the familiar Aerocase liquid-carburizing medium.

Every phase of the metallurgical procedure is accurately controlled as to temperature by means of automatic recording instruments. This control is supplemented by laboratory testing of samples from each batch to assure the maintenance of specified



(Left) All piston pins are checked on this special Magnaflux machine.

(Below) Perspective view of the group of four Cincinnati Centerless machines in the finishing department. The one in the foreground is a finish-grinder, fed by a Danly hopper.

(Bottom of page) One of a battery of large Conomatics in the screw machine department.

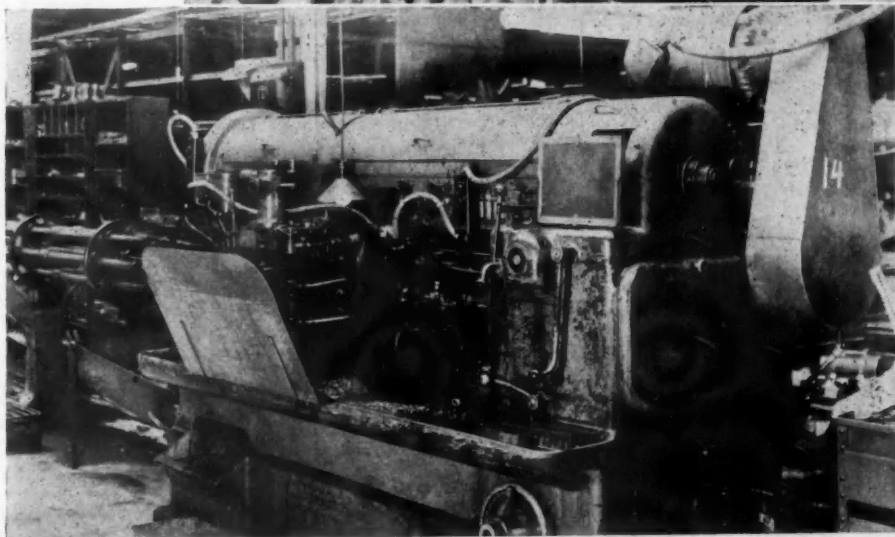
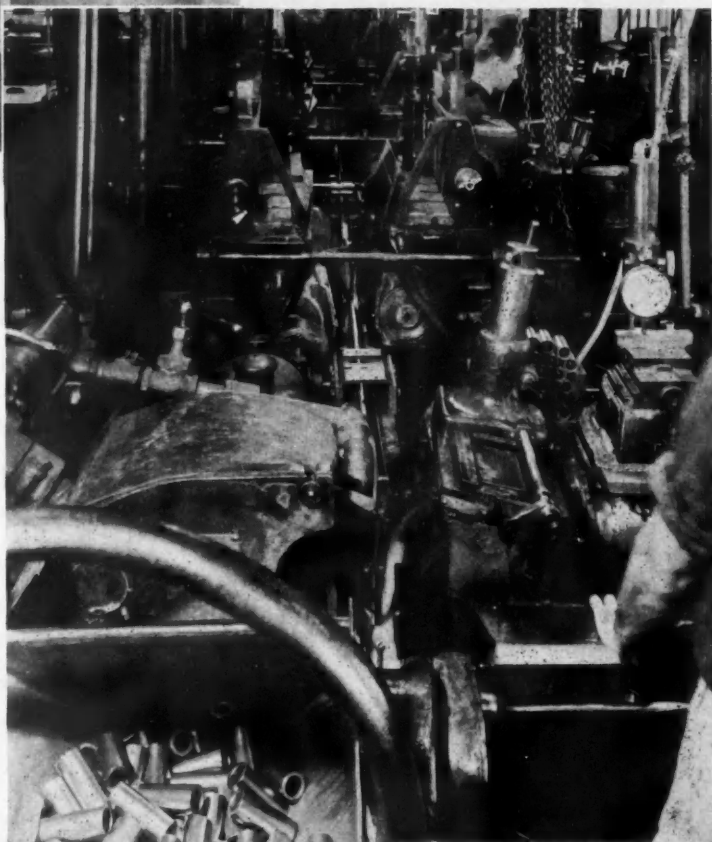
physical properties in the course of production.

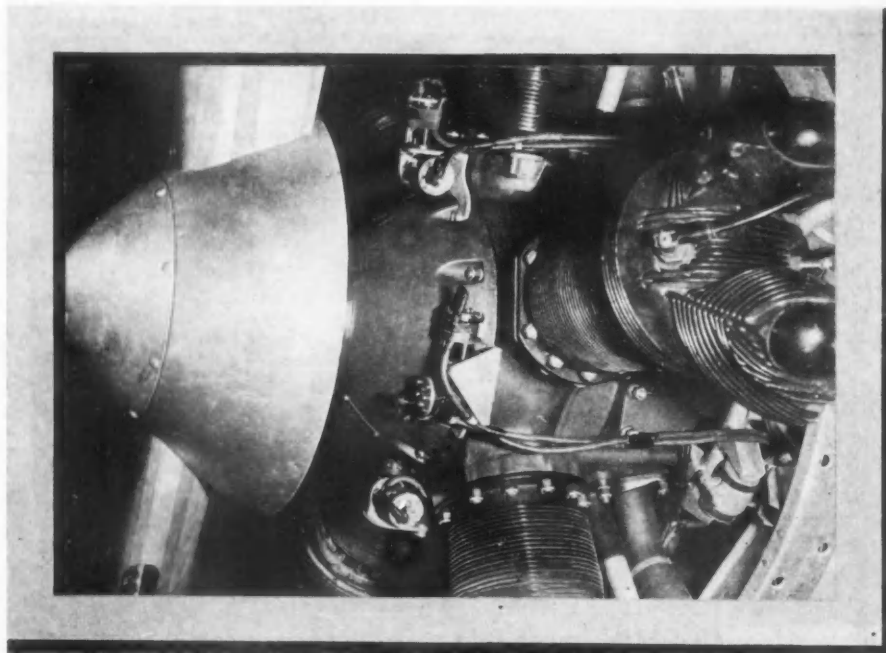
A moderate sized American Wheelabrator unit doubles in brass in the heat treating department. Its principle function is to remove surface scale both on the inside and the outside by sand-blasting. In addition, the refinement of surface enables the operator to detect small soft spots which may occasionally appear. Such pieces are rejected before entering the final stages of finishing.

Following heat treatment, the pins are ready for grinding. Here the finishing operations are closely knit with quality control at every step. Commercial pins usually are rough-ground in Cincinnati Centerless grinders and all sharp corners rounded off on large belt sanders. Aircraft engine pins are rough-ground in Cincinnati Centerless grinders, then the bevel edges or radii are ground on angular-head Cincinnati Filmatic grinders.

To make things more complicated, aircraft engine pins demand a finely finished bore. Usually the bore is first ground on Heald No. 72A internal grinders, then finished-honed on a small, single-spindle, Barnesdril vertical honing machine fitted with Micromatic hones. The honed bore is inspected for size with the new Sheffield Precisionair gage.

Easily the most interest-
(Turn to page 152, please)





Left side of engine showing location of vibration pick-ups.

Combating

**By T. D. Copeland and
Gordon Getline**

Aircraft Laboratory, Wright Field,
Army Air Forces.

EVERY field of modern engineering encounters phases of vibration and the resultant noises peculiar to its own requirements, but it is probably in the field of aircraft equipment and accessories that the most delicate handling of vibration problems is necessary since increased weight cannot be used to absorb excessive vibration. That this problem is an elusive one is typified by a condition that is quite common in aircraft manufacture, and especially true regarding the introduction of new equipment. When the airplane is being designed, all known precautions are taken to avoid leav-

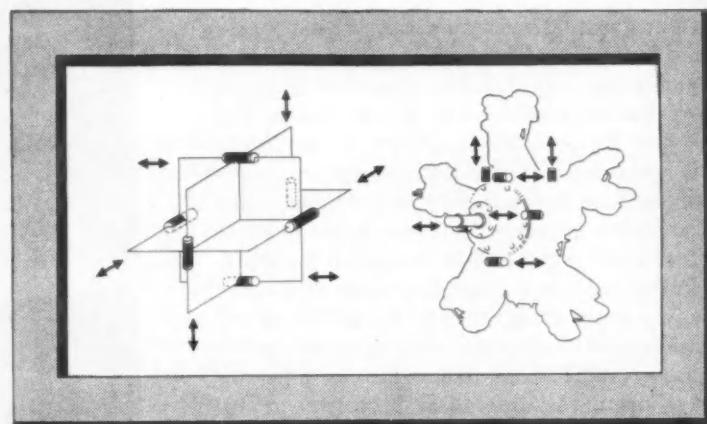
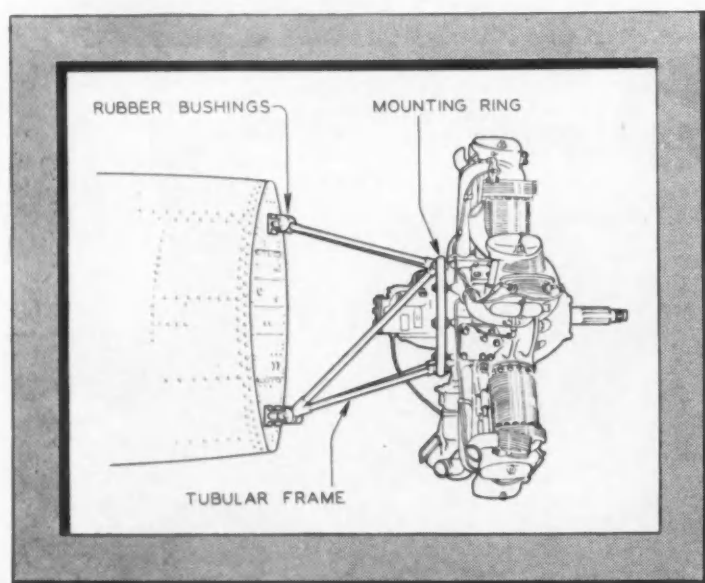


Fig. 2—Schematic diagram of pick-up installation showing six planes of motion.



ing a source of vibration; however, when the preliminary tests on the airplane are run, some obscure location may harbor an unexpected vibration that will require isolation or elimination before tests can proceed to a satisfactory conclusion.

The Army Air Forces long ago recognized the magnitude and elusiveness of this problem, and delegated Wright Field with the responsibility of eliminating this menace to production with all the equipment and skill that it could gather. Since the basic principles of the effect and elimination of vibration have been covered in previous articles in

Fig. 1—Typical installation showing engine mounting attached at firewall by three rubber bushings.

Vibration in Aircraft Power Plants and their Mountings

this publication, the scope of this article will be devoted to some actual problems in the aviation field and how they were effectively solved.

In the early stages of the present emergency many

lem demanded an early solution since it was resulting in the loss of much needed airplanes, and the potentially greater loss of inexperienced student pilots.

The problem centered about the five cylinder air-cooled engine and its directly driven, two-bladed wooden propeller. This power plant group was supported in cantilever fashion by three metal tubes from the mounting ring of the engine to three tubular rubber bushings at the fire wall. The bushings were arranged radially about the center line 120 deg apart as shown in Fig. 1. It was suspected that the excessive vibration was due to the inadequacy of the mounts, and that the natural frequency of the mounts might be within the critical range due to the engine vibration. Likewise it was suspected that the crankshaft had a torsional critical speed and that resonance occurred within the flight operating range.

The first step in the solution of this problem was, of course, to accurately determine the source of the trouble. This was done by placing the appropriate instruments on the engine in such a fashion that they would be able to detect and record any undue motion in any of the six degrees of freedom which are existent for any body suspended in space.

These motions were bracketed by locating six vibration pick-ups, of the seismic (velocity) type, in pairs

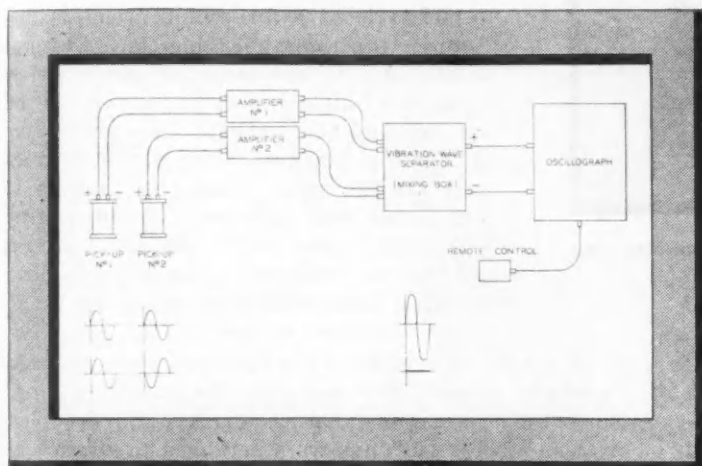
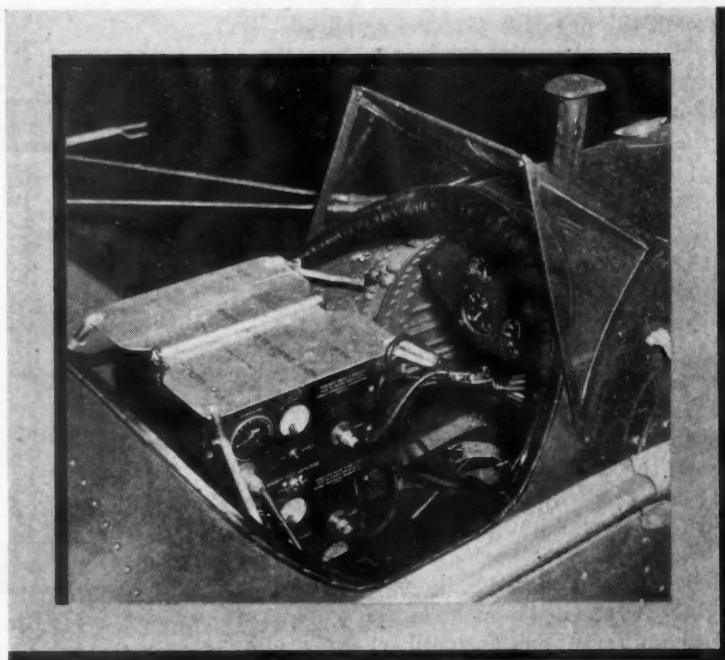
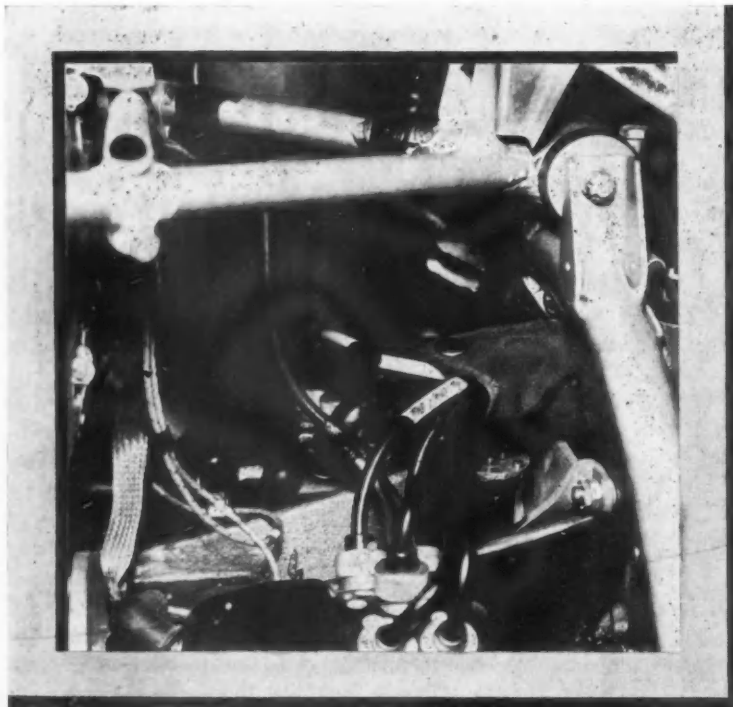


Fig. 3—Layout scheme of vibration measuring equipment.

airplanes were "bought off the shelf," that is they were purchased from blueprints, mockups, or a single experimental model, since the urgency of the situation did not allow sufficient time for a complete service test of the aircraft. One series of aircraft which fell in this category was a small two-place monocoque training plane. Upon completion, this plane was delivered to the Army and sent directly to training schools for immediate use. After a very short term of service, unsatisfactory reports were received which stated that excessive vibration of the power plant group (the engine and propeller) was causing structural failure of the airframe as well as cracking of the fuselage skin and shearing of rivet heads. A few cases of more serious results were evidenced by reports of crankshaft failure; in some cases the pilots were forced to bail out and the plane was abandoned. This vibration prob-

Installation of vibration measuring equipment in front cockpit. A Sperry oscillograph of the remote control type also was installed in the rear cockpit to record vibration.





Closeup view of relocated rubber bushings on engine mounting ring.

equi-distant from the center of gravity of the power plant group (see Fig. 2). The output of these pick-ups was fed through an integrating amplifier to obtain a measure of amplitude, and then to a vibration wave separator which added and subtracted the alternating voltages from the pick-ups. The last step in this circuit was the transmission of these measurements to a recording oscillograph which made a permanent record of the vibrations. In a circuit of this type (Fig. 3) if the pick-ups have outputs (sine waves) which are in phase, and pass through the plus side of the mixing box, a sine wave of twice the original amplitude will result. If they pass through the negative side the amplitudes will cancel out and a straight line will be the result. Readings were taken for each pair of pick-ups to determine the movement in each of the six degrees of freedom, which are:

- (1) Roll (about the thrust axis)
- (2) Pitch (about the lateral axis)
- (3) Yaw (about the vertical axis)
- (4) Thrustwise Translation
- (5) Lateral Translation
- (6) Vertical Translation

A torsigraph was attached to the rear end of the crankshaft to study its vibration characteristics and these movements were also permanently recorded on the oscillograph. When the installation of these instruments was satisfactorily completed, the airplane was flown in level flight during which the speed of the engine was varied from its maximum to the minimum possible for maintaining level flight. A record was made on the oscillograph at each different engine speed for the readings

of each pair of pick-ups and the torsigraph. The vibration records of this test were harmonically analyzed to determine what forcing functions were present in the vibration. Graphs of harmonic motion vs. rpm were then plotted as shown in Fig. 4. A five cylinder radial engine produces important forcing functions of $\frac{1}{2}$, 1, 2 and $2\frac{1}{2}$ times the crankshaft speed. The propeller generates forces due to its own static, dynamic or aerodynamic unbalance as well as the forces that result from the resistance of the air about points of obstruction of the engine, cowling, etc. (blade passage effects). Since a gasoline engine cylinder fires every second rotation of its crankshaft, the forces due to the gas torque cycle of a five cylinder engine are $\frac{1}{2}$ order functions. The inertia forces and couples due to unbalance of the rotating parts of a single row radial engine are of the 1st and 2nd order. The above are the forcing functions from which the records are analyzed. From the analysis it was found that resonance of the engine (1st order) occurred in the flight range, and that the crankshaft was found to have a critical speed within the operating range due to $7\frac{1}{2}$ order excitation.

To correct this problem the bushings were removed from the firewall and placed at the mounting ring, since the original installation was a highly coupled system. These bushings were arranged to effectively support the power plant at its center of gravity. By doing this the transmitted forces would not have the added effect of overhand. At the same time the stiffness of the bushings was reduced to make the natural frequency occur below the lowest flight operating speed. This reduced the transmitted forces since vibration isolation begins when the natural frequency

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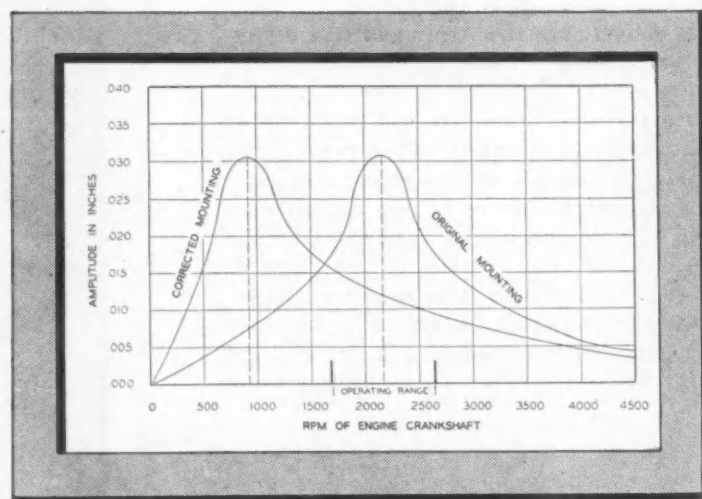


Fig. 4—Harmonic motion curves of vibration for each method of engine mounting.

Expansion of 24S Alclad Aluminum Sheet During Heat Treatment

By William T. Kluge

Research Engineer,
North American Aviation, Inc.

DATA on the expansion of Alclad 24SO and 24ST aluminum sheet resulting from one and two heat treatments, as determined by North American Aviation, Inc., are presented in Figures 1 to 4, which may be summarized as follows:

1. Expansion of 24SO upon heat treatment, Fig. 1
 - a. Upon heat treatment 24SO Alclad sheet of 0.025 in. thickness has an average expansion of 0.0015 in. per in.
 - b. With increased sheet thickness, the expansion declines rapidly.
 - c. The expansion is 30 per cent greater perpendicular to the direction of rolling than parallel to it.
 - d. The variation of the expansion between sheets, indicated by the shaded band on the curve, is roughly 25 per cent of the elongation.
2. Expansion of 24ST upon heat treatment, Fig. 2
 - a. Upon heat treatment, 24ST Alclad sheet has an expansion of less than 0.0005 in. per inch, both parallel and perpendicular to the direction of rolling in all thicknesses within the range from 0.025 in. to 0.064 in.
3. Additional expansion of 24SO upon reheat treatment, Fig. 3
 - a. By heat treating 24SO (as received) Alclad sheet a second time a further expansion resulted of approximately 50 per cent of that shown by the first heat treatment.
 - b. The effect of the direction of rolling upon the amount of expansion was the same as that produced during the first heat treatment, namely the additional expansion was 30 per cent greater perpendicular to the direction of rolling over that parallel to the direction of rolling.
 - c. The variation of the expansion between sheets of similar thickness was somewhat greater after the second heat treatment than after the first.
4. Additional expansion of 24ST upon reheat treatment, Fig. 4
 - a. By heat treating 24ST (as received) Alclad sheet a second time a second expansion was noted which approximately equaled that noted after the first heat treatment.

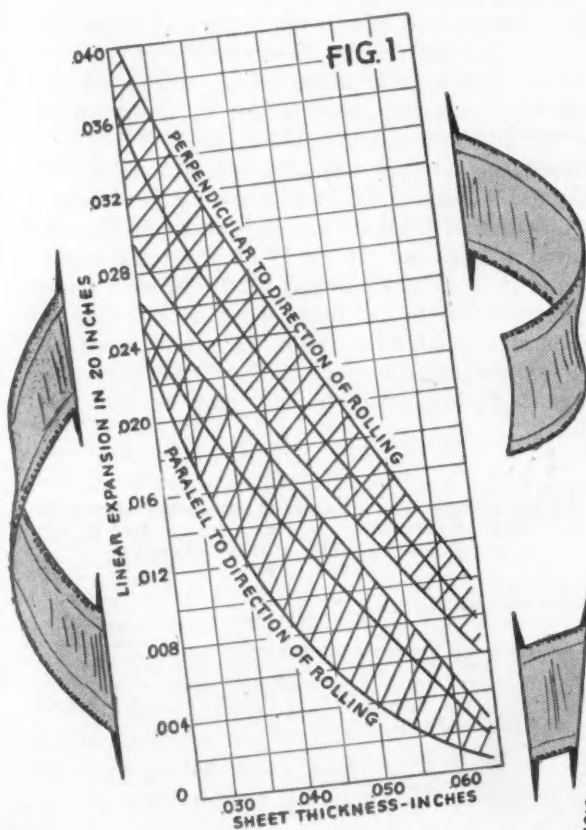
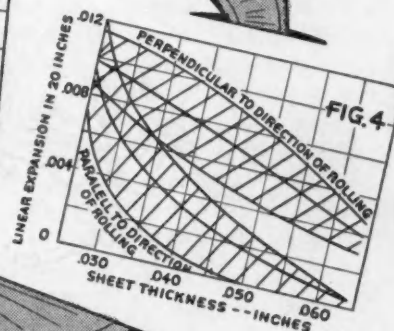
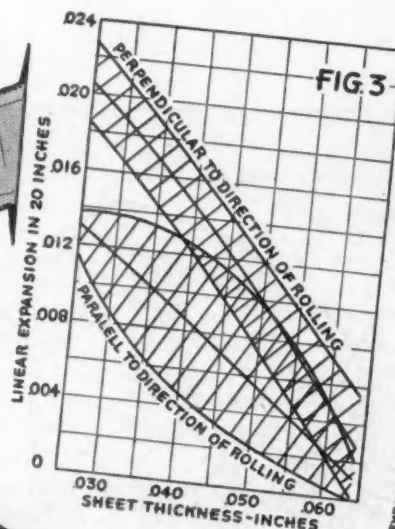
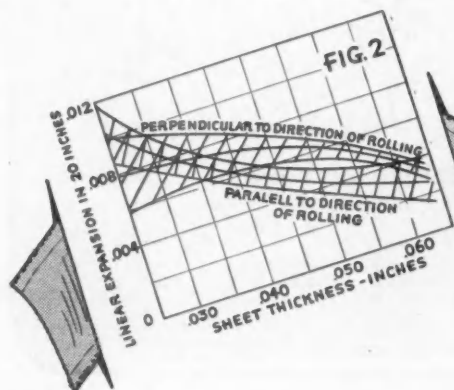


Fig. 1—Expansion of 24SO Alclad aluminum sheets upon heat treatment

Fig. 2—Expansion of 24ST Alclad aluminum sheets upon heat treatment

Fig. 3—Expansion of 24SO Alclad aluminum sheets upon heat treatment for second time since in "SO" condition

Fig. 4—Expansion of 24ST Alclad aluminum sheets upon heat treatment for second time since reception in "ST" condition



Rear Engined

By M. W. Bourdon

Special Correspondent of
AUTOMOTIVE and AVIATION
INDUSTRIES in Great Britain

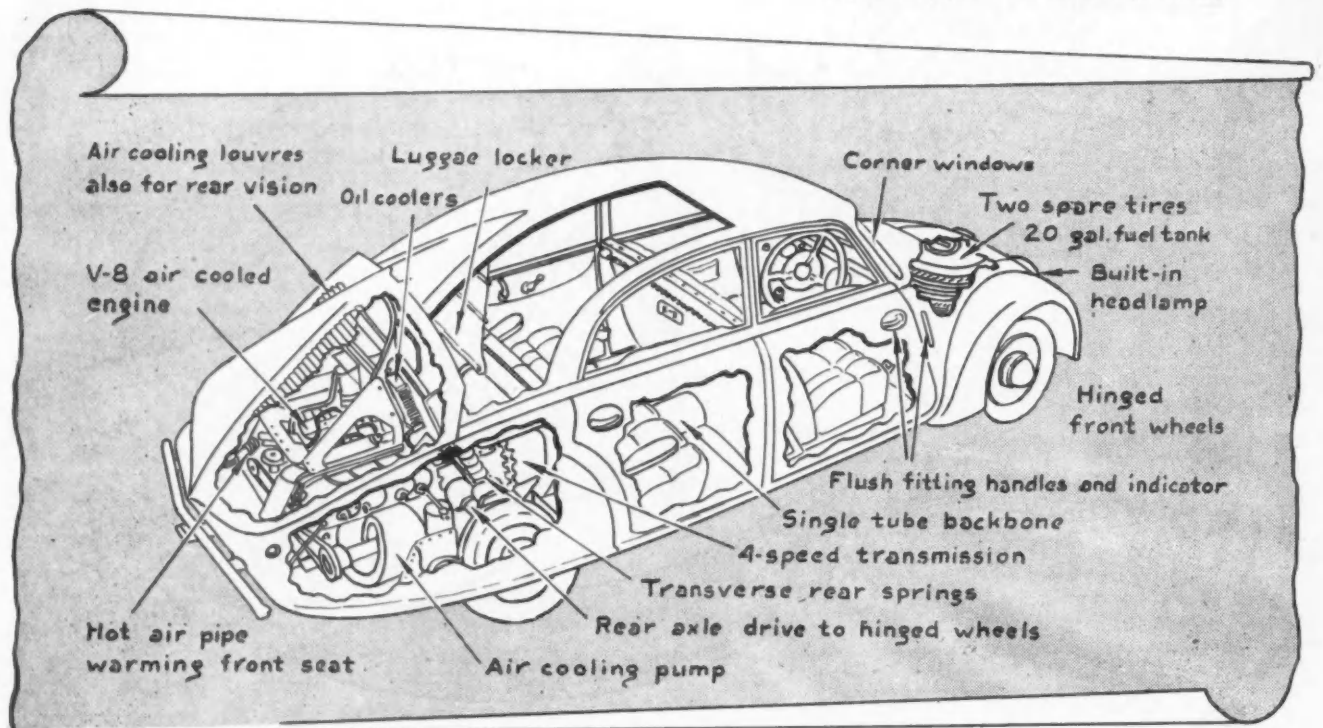
IN VIEW of the increasing interest that of late has been displayed in the possibilities and prospects of rear-engined passenger cars, it is appropriate at this time to recall some of the outstanding features of one of the best known, prior to the war, among European products of this type. The Tatra, which is the car in question and about which a number of inquiries has been received recently, was designed and produced in Czecho-Slovakia. As known in England prior to 1939, it was notable in the fact that, besides the location of its engine, it combined this unorthodox feature with air-cooling, a "chassisless" construction and independent suspension at both front and rear.

Tatra cars were exhibited at several of the annual automobile shows held in London before the war. As far back as 1932 they embodied unconventional features. Thus, in the year just mentioned there was a four-wheel-drive model, termed the "Colonial" type,

which had eight speeds. In the same year there was a twelve-cylinder (366 cu in.) model. But each of these and several other models introduced from time to time had the engine at the front, and it was not until the London show held in the autumn of 1934 that the first rear-engined Tatra appeared in England. It had a V-8 engine of approximately 183 cu in. displacement, the bore and stroke being 2.96 in. by 3.31 in. At the 1936 London show a larger engine was offered, of the same design and stroke but with a cylinder bore of 3.15 in., making the displacement 208 cu in. (At the Berlin show in 1939 Model 87 was exhibited with the 183 cu in. engine, specifications of which are included in the accompanying table.—Ed.)

In 1938 the Nuffield Organization, which controls the Morris, Wolseley, M.G. and Riley car manufacturing interests and those of Morris Commercial trucks, purchased a Tatra car (Model 77) for test and experiment, and it is by the courtesy of Sir Miles Thomas, vice-chairman of the Nuffield Organization, that the writer is able to give the following particulars taken from a translation of literature issued with the car by the manufacturers. And here it may be said that,

This drawing was made from a part-sectional perspective view of the Tatra car drawn by the late F. Gordon Crosby for The Autocar (London).



Tatra Car

after the car had served the purposes for which it was acquired, it was resold in 1940 and Sir Miles Thomas is unable to state its present whereabouts. As the foregoing suggests, the Tatra car purchased by the Nuffield Organization represents the latest model of which particulars are available in England.

With its eight cylinders forming two banks set at 90 deg, the engine of this latest known model was mounted with its crankshaft axis arranged longitudinally. The flywheel and clutch were located at front of the engine. From the single-plate clutch torque was conveyed to the unit-constructed four-speed transmission by a shaft passing forward through a hollow first-motion gear shaft. Transmission to the final drive and differential was through helical gears for the second, third and fourth speeds and straight-toothed pinions for first and reverse. Synchromesh was provided for the third and fourth speeds only.

Engine, transmission and final drive casing formed a unit attached to the body structure with three-point suspension. Power from the differential to the rear wheels was through short, transverse shafts with cardan-type universal joint at each end. Rear independent suspension was effected by an inverted half-elliptic spring, passing over the differential casing, secured at the center to the body and at the ends to units forming the brake anchorages and the short axles of the rear wheels.

A transverse and inverted half-elliptic spring also served for the front independent suspension, the spring being centrally attached to the body at a point stiffened to resist torsion. Parallel links located the wheels.

The "self-carrying" body (to quote the manufacturer's descriptive term) was almost wholly of pressed sheet steel construction, but an important feature was a tubular stiffening member, a "backbone," running centrally from front to rear at the floor.

Reverting to the engine, the cylinders were cast in pairs, separate from the crankcase and with detach-

able heads. The latter and the cylinders were secured to the crankcase by "through" bolts. Between the cylinder heads of the two banks of cylinders was a central induction manifold that also served to support the valve rockers. The manifold was heated by exhaust gases, at a point below the downdraft carburetor, to form a hot spot. Valves were vertical, with bronze guides and seats, and operated by a three-bearing camshaft, silent chain-driven within the

crankcase. The crankshaft was built up of three sections, with cranks at 90 deg and 180 deg respectively. It ran in three bearings, the front one taking axial thrust and passing oil into the hollow crankshaft for the big-end lubrication.

Pressure lubrication was effected by two gear-type oil pumps in the same casing and driven by the same shaft through helical gearing from the front end of the camshaft. The main oil pump drew oil through a filter in a 2 $\frac{3}{4}$ -gal tank attached to the crankcase and delivered it under pressure. The auxiliary pump drew oil from the bottom of the tank and forced it through two oil coolers back to the tank. The oil coolers were in the air stream, in front of the engine above the rear axle center.

Air-cooling of the cylinders and heads was effected by two duplex blowers, one on either side of the engine, each one belt-driven within a scroll casing immediately below the adjacent cylinder bank. Air was taken in at both sides of the duplex runner and discharged centrifugally into the center of the scroll casing, which, "fanning-out" at front and rear, carried the air directly into jacketing around the barrels and heads of the front and rear pairs of cylinders. The generator was coupled to the right-hand blower.

The service brake system is the hydraulic type with Lockheed brake mechanism at the wheels. The hand brake lever applied the rear brakes only, with compensated cable operation. A 20 gal fuel tank was fitted inside the front extension of the body structure normally constituting the engine hood. Fuel feed

(Turn to page 150, please)

Tatra Car Specifications

Models 77, 77A and 87

Cylinder Arrangement	Eight, 90-deg. Vee
Bore and Stroke: 77 and 87	2.98 by 3.31 in.
77A	3.15 by 3.31 in.
Displacement: 77 and 87	183 cu in.
77A	208 cu in.
Max. BHP: 77	60
77A	70
87	75
Fuel Consumption	18-20 mpg.
Oil Consumption	900-1350 mpg.
Gear Ratios: 1st	4.14:1
2nd	2.70:1
3rd	1.59:1
4th	1.00:1
Rev.	5.75:1
Final Drive Ratio: 77	3.75:1
87	3.00:1
Wheelbase	124 in.
Tread	51 $\frac{1}{2}$ in.
Ground Clearance	9 $\frac{1}{2}$ in.
Turning Radius	25 $\frac{1}{2}$ ft.
Weight	3775 lb.
Maximum Speed: 77A	94 mph.
87	100 mph.

Table I

Truck Dimensional Limitations Recommended by National Interregional Highway Committee.

Width	96 in.
Height	12½ ft
Length (Overall including bumpers and load):	
Single Vehicle	35 ft
Tractor and Semi-Trailer Combinations	50 ft
Other Combinations	60 ft
Axle Load* on Pneumatic Tires	18,000 lb

*Defined as the total load on all wheels whose centers may be included between two parallel transverse vertical planes 40 in. apart.

PROBABLY the most definite information concerning the kind of thinking now being done about highways of the future is contained in the Report of the National Interregional Highway Committee recently transmitted to Congress in House Document 379. This report submits a proposal for a road system embracing a total of 33,920 miles, of which 29,450 miles are in rural sections and 4470 miles are in urban sections. The total mileage is 1.04 per cent of the 3,267,717 miles of rural roads and urban streets in the United States. Although this figure may seem insignificant, the supporting data in the report reveal that it will provide a surprising service, for the proposed system will connect all cities containing 300,000 population and over, and will connect 587 cities having a total population of 51,805,000 out of 1077 cities with a total population of 62,716,000.

In view of the fact that the report considers a program involving billions of dollars and many years, the accompanying tabulation from it (Table I), which gives the truck limitations in weight, width, height, and length, is of interest. One of these provisions, certainly, should receive careful study. While the width of traffic lane proposed is 12 feet, the width of the vehicle is limited to 96 in.

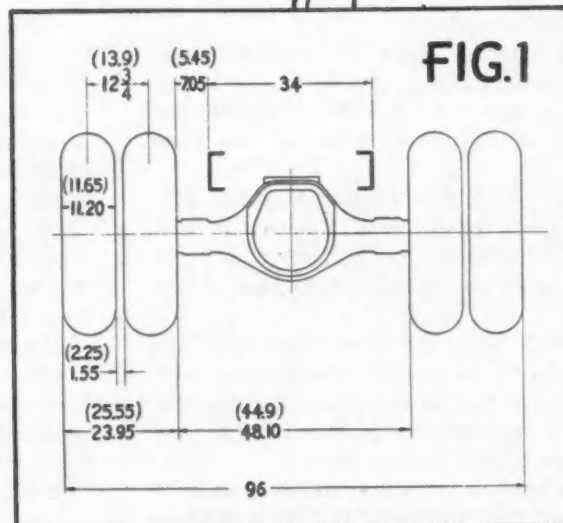
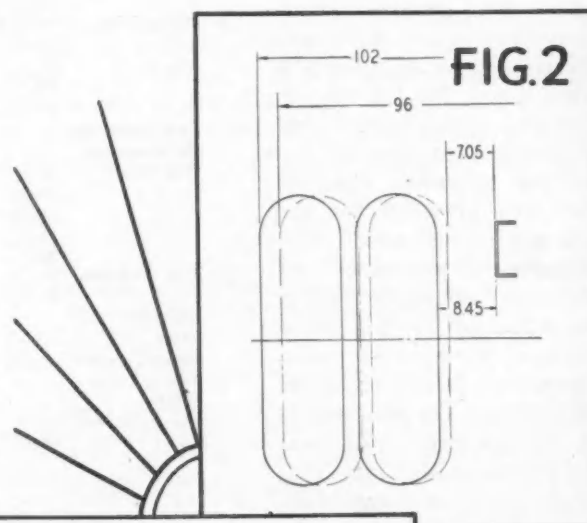
Since all states have adopted this width limitation except Connecticut and Rhode Island, which permit 102 in., the 96-in. width seems to have been established on very solid reasoning. However, an analysis of the subject develops some very important questions. The smallest pneumatic tire that can be used to match an 18,000-lb axle load (the maximum permitted by the report) is the 10.00-24 with a rating of 4550 lb. The use of the 24-in. base diameter tire is undesirable in highway work owing to the extra height of center of gravity which it produces.

A reduction in diameter of base makes an increase in cross section to 11.00 in. necessary to reach the desired rating. The 11.00 in. tire mounted on the 7.33V (9-10) rim with 12¾ in. spacing requires an overall tire space of 23.95 in. with 1.55 in. between tires, leaving a space between the inner tires of 48.10 in. (see Fig. 1).

Future

Recent proposals by the tire manufacturers based on experiments made by them indicate that desirable improvement in tire life can be obtained by increasing the width of the tire base. At present the width of the base for the 11.00 in. tire is 7.33 in.

By increasing the base of an 11.00 in. tire to 8.37 inches, there would result a desirable distribution of flexing in the side walls, a reduction of side rolling of the tire and an increase in air volume. Unfortunately, this requires an increase in tire spacing and causes an increase in the tire cross section. On the 11.00 in. tire, the spacing is made 13.9 in. and the cross section is increased to 11.65 in., which are shown in parentheses in Fig. 1. The space occupied by the



Highway and Truck Design

By B. B. Bachman

Vice President in Charge of Engineering,
The Autocar Company

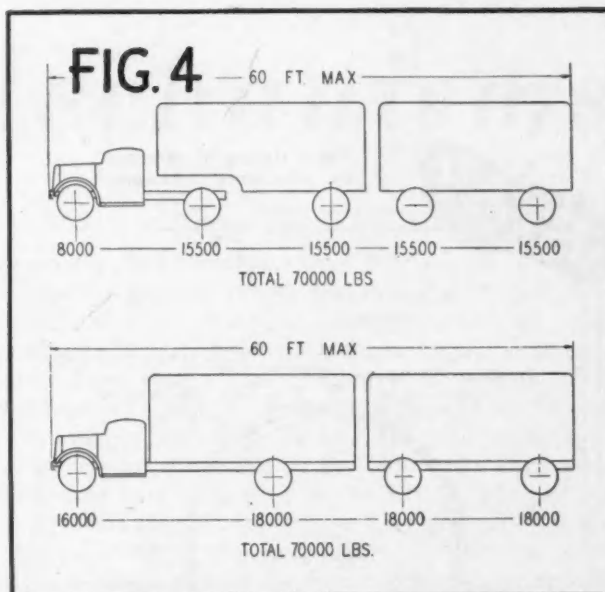
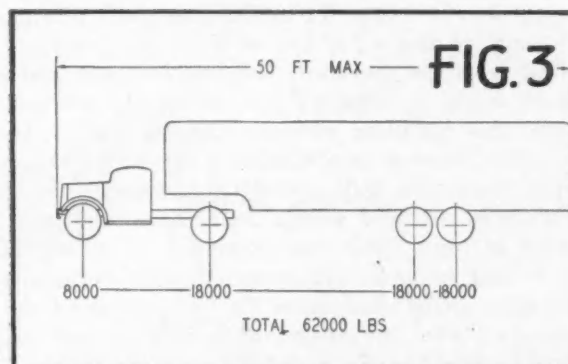


Table II

Comparative Data on Trip Time and Fuel Consumption for Ardmore Pittsburgh Truck Operation.

Ardmore-Pittsburgh, Round Trip 570.7 miles; (Penna. Turnpike, Round Trip, 319.2 miles; Balance outside Turnpike, Round Trip 251.5 miles).

Engine	Trip No. 1 377 cu. in.	Trip No. 6 501 cu. in.
Axle Ratio	6.53-8.53 Single Reduction Two-Speed	6.77 Double Reduction Single-Speed
Running Time Full Trip	18.15 hr	15.37 hr
Time Saved		2.78 hr
Running Time—Turnpike	9.00 hr	7.50 hr
Time Saved		1.50 hr
Gasoline Consumed Full Trip	115.15 gal	115.70 gal
Gasoline Saved	.55 gal	
Gasoline Consumed Turnpike	61.70 gal	63.90 gal
Gasoline Saved	2.20 gal	

duces elements of weakness. Finally, we have left 10.9 in. into which the springs, clips and clearances must be located, a totally inadequate space for a decent spring design.

Limitations of width make no distinction between the wheels and the body. Yet it is the width of the body alone which limits vision, whereas both the width of the body and side sway determine the clearance requirements. It seems obvious that the space occupied by a body 96 in. wide in

two tires is 25.55 in., which leaves 44.9 in. between the inner tires, or less than half the allowable overall width. Into this space must be compressed the brakes, springs and frame. The brakes, of course, have long ago been pushed back under the tires, a location which leaves much to be desired for both the tires and the brakes. The frame is generally 34 in. wide, a figure arrived at by the requirements for the power plant installation and a straight frame rail. Although an offset in the frame rail in the horizontal plane can be made without causing production troubles, it intro-

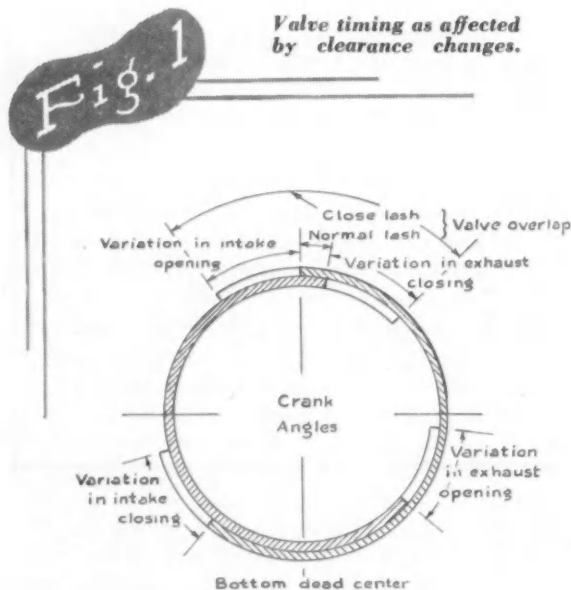
motion will exceed 96 in. by an appreciable amount. It would seem practical, therefore, to increase the width over the tires to a greater dimension than the body. These factors were recognized in the report approved in 1935 by the SAE Council which proposed that the body width be set at 96 in., but that 102 in. be permitted up to the rear fender top line. This additional six in. would make possible important design changes in trucks and buses that would favorably affect both safety and performance.

If 102 in. were allowed up to the top line of the rear fender, half of this increase could be allotted to the tire width, as shown in Fig. 2, and the remainder could be used to provide longer and wider springs with

(Turn to page 62, please)

* This article is based on the paper, "Trucks", which Mr. Bachman presented April 25 at the 15th Anniversary Meeting of the Pittsburgh SAE Chapter.

Automatic Clearance



AS THE problems brought about by hostilities are being envisaged, the thoughts of designers are directed toward greater economy. The vast mass production experience gained, the facilities which will become available and new economic postulates will in a short time become the impetus for the manufacture of more economical engines. In their evolution the valve mechanism, as in the past, an important factor.

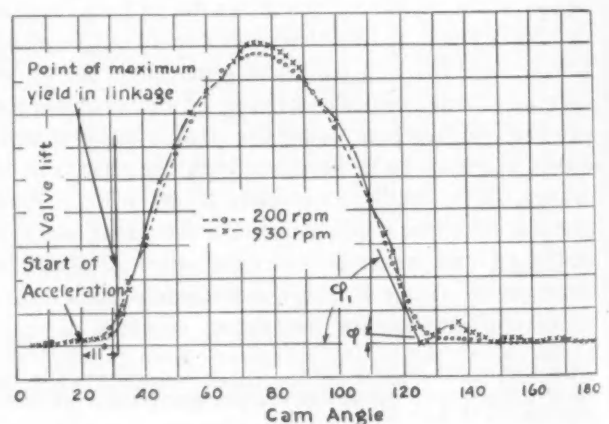
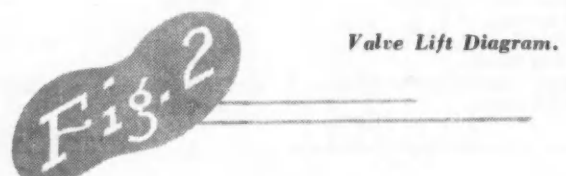
Fuels of higher octane rating will become available for general use. They of course, can be used economically only in engines of higher compression ratios and because an 8 to 1 compression ratio has been found the ceiling for the L-head type of engine, there is some evidence that designers will find a wider scope by turning to the pushrod-operated, overhead valve type of engine. This will call for a more definite solution of existing valve linkage problems. Any development in that direction also will aid in the development of more powerful and more economical aircraft engines.

Linkage Clearance And Cam Ramps

In operation the valve linkage yields and con-

tracts. It restitutes preceding yield and expands different amounts than the units upon which it is mounted. During the opening of the valve the driving force is derived from the camshaft, and the yield and lost motion cause a lag in velocity; but during the closing of the valve this condition reverses, thus disturbing the relationship between cam contour and valve linkage. Unequal expansion and contraction upset the conventional clearances provided within the linkage, and large clearances in high speed mechanisms cause heavy impacts, noise and failures. To overcome these serious defects, so-called ramps were added to the contours of the cams. However, with the advent of high duty engines, these ramps have become a definite detriment. At certain stages of operation the clearance is less than normal, causing the valve timing to stretch out as much as the aggregate lengths of the ramps, an illustration of which is given in Fig 1. Such an unduly stretched out timing causes loss of power at low speed, poor idling and starting, and hot valves, which in turn cause spark rap, roughness, preignition, burning of valves and consequent leakage and failures. Under other operating conditions this clearance will be large, resulting in undue noise and impacts that lead to failures.

The valve mechanism of an engine controls its breathing quantitatively and to some extent qualitatively. To

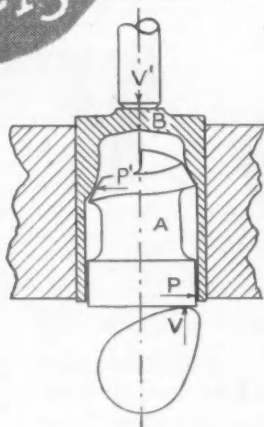


By Otto M. Burkhardt

Regulators for Poppet

Valve Mechanisms

Fig. 3



Conventional manual clearance adjuster incorporating locking device to prevent rotation of threaded members.

insure quantity, *i. e.* highest volumetric efficiency, the intake valve may be opened considerably before the exhaust closes. This, however, becomes a serious detriment at part throttle operation, for the exhaust blows into the intake system while both valves are open. Some of this valve lift overlap generally has to be accepted and can be provided for by enriching the mixture. But if it becomes excessive, as it will with wide variations in the valve linkage clearance or long stretched out ramps, then the problems become so serious that various automatic valve clearance regulators have been designed to overcome them. As the name implies, these devices adjust automatically, even if the valve linkage clearance is due to surge or rebound, and that is the most formidable problem encountered with them.

Acceleration Through Yielding Linkage

Failures and noises in valve mechanisms have indicated that the actual velocity of the valve changes periodically as the revolution speed is increased. Very small changes in the cam contour often bring about disproportionate changes in noise, as has been verified by observations with stroboscopic and other

measuring instruments. This is given as a warning rather than as advice to tamper with cam contours, unless it is thoroughly understood that the valve motion is far from a true replica of the cam contour. The cam contour designer must bear in mind that under accelerating and clearance impacts the valve linkage will yield considerably. He knows that his efforts are controlled by the fact that within some 25 deg of cam motion or better within .002 sec, all acceleration should be over, and only a sturdy linkage will insure that. In pushrod-operated, overhead valve engines this problem is more serious because the direction of motion from cam to valve must undergo important directional changes and the total yield of the linkage increases not only in proportion to the acceleration and the mass, but also with the various contact surfaces as well as the axial and the lateral stability of the linkage.

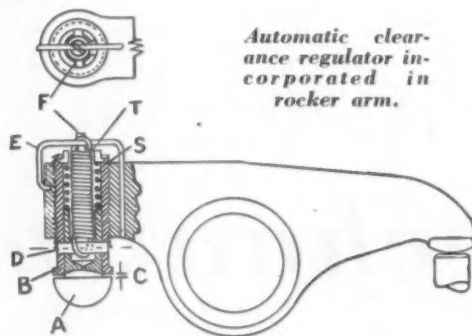
There are many other important reasons for the deviation of the actual from the theoretical valve motion and the result is that even at normal engine speeds a combination of motions is observed. The

Fig. 4



Tappet with automatic clearance adjustment using spring to prevent rotation.

Fig. 5



Automatic clearance regulator incorporated in rocker arm.

deviations have sometimes been called false motion, and earlier experimenters have attributed them to the higher harmonics that can be demonstrated mathematically with Fourier's Series to be inherent in the cam contours. It is now well known that a mathematical analysis of the cam contour must not be mistaken to represent an analysis of the valve motion as well. During the valve closing period the valve spring and later the inertia actually drive the camshaft, causing a complete gain by take-up and reversal of lost motion. Naturally a very serious deviation from the conventional calculations results.

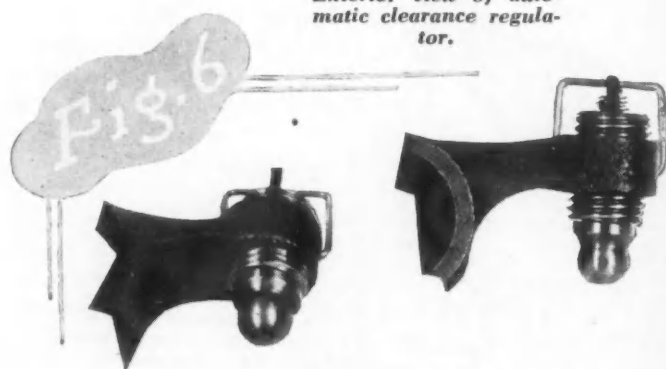
Aperiodic Acceleration

Many highly specialized cam contours have been tested, but the results have been uniformly disappointing as long as the chosen acceleration pattern was such as to impart continuous acceleration and consequently cumulative deflection of the linkage. A decided improvement, however, has been noted when the acceleration is aperiodically or intermittently applied. For instance, we apply maximum acceleration for deg, more or less, and the yielding linkage will transmit it to the valve in a modified pattern, depending on the axial and lateral rigidity of the linkage. Now a valve linkage that has reached maximum deflection after 4 deg of camshaft motion at high speed is very good and will probably be relatively free from surge. Four deg camshaft motion at 1666 camshaft rpm or 3333 engine rpm would correspond to a surge frequency of about 1250 cycles per second, which is a good deal higher than ordinary valve spring surge frequency. Many linkages, however, reach maximum yield only after 10 deg camshaft motion. In either case a break in the acceleration for the duration of one deg affords the linkage an opportunity to reconstitute itself. The valve continues to move during this dwell period and the linkage frees itself as if the inflection point of the cam contour had been reached. If, then, acceleration is again applied, the linkage is newly realigned and it is better capable of surge-free transmission of motion to the valve.

To eliminate as far as possible the surge from the

valve linkage is a basic requirement for the most successful use of automatic valve adjustments. In fairness, however, it must be pointed out that these devices are not designed to correct surge, but rather, in fact, increase it by adding weight to the linkage. Although great commercial success has been achieved with automatic valve lash adjusters, the fact remains that they have been more readily accepted by manufacturers of L-head engines than by those who specialize on overhead valves, even though the latter have greater need for them than do the former. More important still, some manufacturers of aircraft engines seem to hesitate in spite of the fact that radial air-cooled engines need them far more than liquid-cooled automobile engines. The problem obviously lies in the fact that pushrod-operated, overhead valve engines suffer more from valve linkage yield and restitution

Exterior view of automatic clearance regulator.



than L-head engines. Any addition of weight to the linkage may aggravate that condition so that without the elimination of surge, the advantages of the automatic adjustment can not be fully realized. It would seem, therefore, that the design of a quiet and efficient valve linkage requires the elimination of clearance variation through the use of a clearance regulator, providing this device adds no weight to the linkage. In any event, an aperiodic acceleration will prove useful.

Requirements For Clearance Regulator

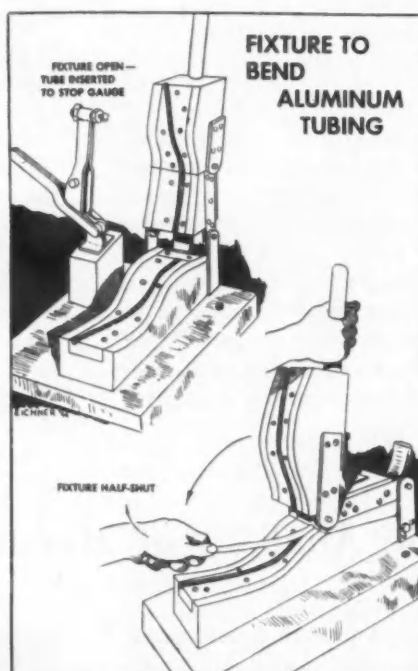
A pair of typical valve lift curves is shown in Fig. 2. The surging and bouncing of the valve is direct proof that lack of control over the valve motion throughout the entire lift is the cause of serious trouble. The tangents of the angles ϕ and ϕ_1 are direct measures of the closing velocities at low and at operating speeds respectively. To appraise the closing impacts, we must bear in mind that these increase as the square of the closing velocity as well as in proportion to the mass. Under the circumstances it is no wonder that valves rebound, nor is it strange that designers speak of false motion or worse.

We will now give a few samples of tests which have yielded a number of disappointing results. These tests, which started in 1928, were uniform only in so far as they all proved that valve mechanisms are harassed by many motions other than the true valve motion and



A rotary grind adapter which permits the automatic grinding of the full width of a valve seat without stopping a machine to load or unload, is a recent development at the Republic Aircraft Products Division of The Aviation Corp. The device includes an adjustable spring-loaded shoe mounted on the machine guard. The shoe contacts the rotating adapter and expands a spring collet which grips the inside diameter of the work. The part is thus held in position while the grinding wheel passes over the surface, sizing it to the proper width. Removal of the grinding wheel from contact with the work simultaneously removes the pressure of the shoe on the adapter. This releases the part, which can be removed from the collet to make way for another valve seat without stopping and re-starting the machine. An increase of 50 per cent over the previous production rate is reported.

Short

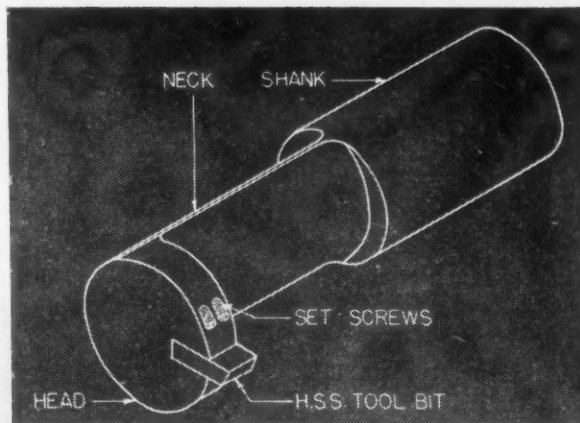
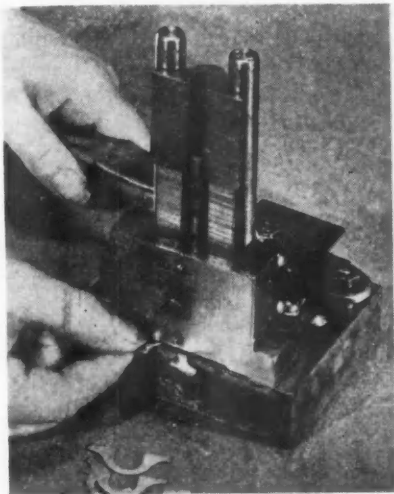


Using this fixture to bend aluminum tubing makes possible the elimination of a considerable amount of mechanical set-up prior to the operation. It consists of two form blocks hinged together. The tubing is placed in the groove of the lower block and the upper block is lowered sharply to form the part. Two or more bends can be made in the tubing in one operation providing the bends are in the same plane. The fixture was developed at the Murray Corp. of America.



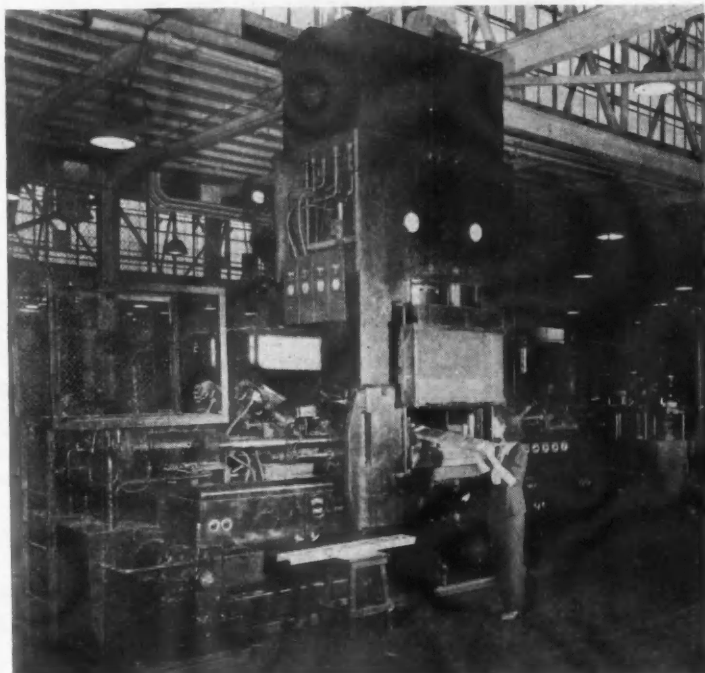
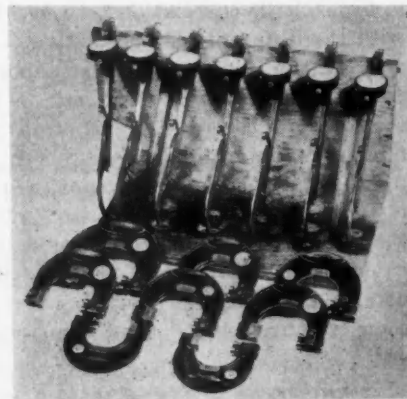
This Legimeter, which was developed at The Glenn L. Martin Co., is a device for pre-determining whether or not a drawing will reproduce satisfactorily while it is still in the hands of the draftsman, or in the case of older drawings, before they are sent to the blue-print machines. It consists of a two-panel illuminated table. In the first panel are samples of drawings from which satisfactory prints have been made by the Army and Navy, selected as standards of minimum satisfactory contrast. The second panel is a clear sheet of ground glass on which the draftsman can place the drawing to be evaluated. Since both panels are illuminated by light of the same intensity, it is possible to determine at a glance whether or not a drawing is heavy enough for satisfactory reproduction. In addition to the comparison table, the Legimeter includes additional devices for the instruction and training of inexperienced draftsmen in a three panel backboard.

Cuts



Now in use on a turret lathe at General Electric's Pittsfield Works is a special boring bar, which permits a heavier cut with less tool chatter and breakage than is possible with conventional bars. It is employed to reach through a bored hole beyond which a larger diameter bore or recess must be machined. That section of the neck of the bar which is at right angles to the tool bit is left as large as possible for its contributing strength. The remainder of the neck is cut down so that the reduced section conforms on two sides only to the circumference of the bore through which the bar must reach. Since the head of the bar is offset and large enough to pass through the bored hole with the tool bit inserted, a depth of recess equal to the overhang of the tool bit from the neck of the bar is possible. The tool bit is furnished full support by the reinforcing stock of the head.

Faced with the problem of counting out a specified number of .002 in. connecting rod bearing shims in the packaging of Studebaker truck parts, engineers developed the above device. The shims are first stacked vertically in the machine and weighted down. A hinged plunger is then moved against the bottom of the stack, pressing a measured thickness of shims through a slot. Extreme accuracy was necessary in the machining of the face of the plunger, the slot and the weight placed on top of the shims. In addition, a razor edge was worked on the plunger to separate groups of the shims. The counting was formerly done by scale. The idea reduced time on the job by a high percentage.



To gage the grinding of eight bearing surfaces on the crankshafts for its radial, air-cooled aircraft engines, the Lycoming Division of The Aviation Corp. has provided a series of standard gages, equipped with dial indicators. Each gage is pre-set for a different crankshaft bearing surface diameter and is held in position by a standard grinding gage arm. An operator has only to select the proper gage as he grinds the series of bearing surfaces. By this method, eight bearing surfaces are ground without removing the crankshaft from the machine.



At the tire plant of the Ford Motor Co. this 500-ton HPM Fastraverse press is used to rivet fin bulkhead spars for B-24 bombers. In a single operation 270 rivets are headed on two spars, a total of 10 minutes being required, or five minutes per spar, as compared to 25 minutes per spar by hand riveting.

Improved Methods for Determining the

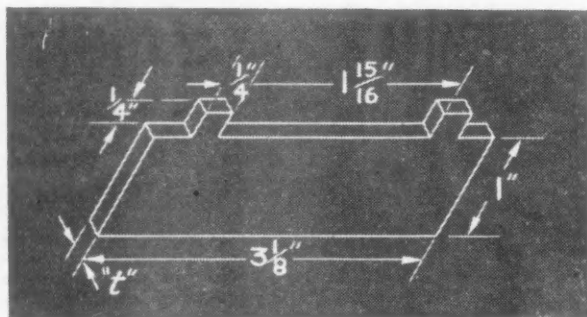


Fig. 1—"Sandwich" test coupon.

PROCEDURES for determining the compression properties of sheet metal and other materials are still in the development stage, and apparently each testing laboratory has its own method of determining the yield stress, the ultimate stress, and the deformation of thin sheets in compression. There is, at times, little correlation between the results obtained with the different methods.

When the Engineering Test Laboratories of Consolidated Vultee Aircraft Corp. at San Diego, Calif., initiated several large test programs which called for numerous determinations of both tensile and compressive properties, a survey of the field was made, and it indicated that there was no method of obtaining the compressive properties of thin sheet-metal coupons rapidly and accurately. Several excellent methods of determining these properties were in use, but all of them required more time than could reasonably be

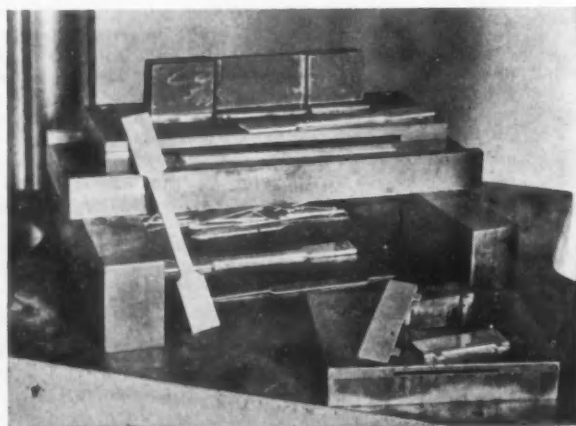


Fig. 2—Tensile and compression test coupon blanking dies.

devoted to the tests in large programs. The Consolidated Vultee laboratories therefore carried through a project with the object of developing a simple test procedure and the necessary test equipment for quickly and accurately determining the compressive properties of thin sheet-metal coupons. In this development work the following reports proved quite helpful:

NACA Report No. 649, "The 'Pack' Method for Compressive Tests of Thin Specimens of Materials Used in Thin-Walled Structures," C. S. Aitchison and L. B. Tuckerman, 1939.

NACA T.N. No. 819, "Comparison of Stress-Strain Curves Obtained by Single-Thickness and Pack

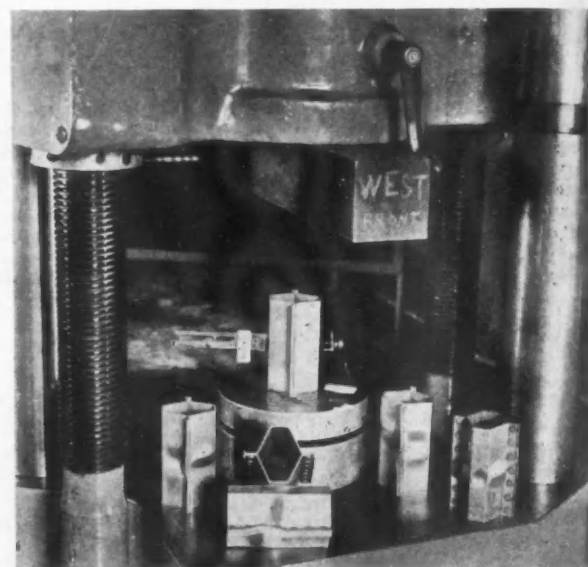


Fig. 3—Test of prestretched extruded hat stiffeners compression setup.

Methods," D. A. Paul, F. M. Howell, and H. E. Grieshaber, August, 1941.

Apparently a similar development had been under way at the National Bureau of Standards (Project No. 65126) for the Bureau of Aeronautics (Project No. 4023), Navy Department, and a report thereon appeared in Structures Memorandum No. 10, Serial No. 13, issued in November, 1942, under the title "Compressive Tests of Sheet Metal with Solid Guides for Lateral Support."

During the early part of 1940 the "block" or "stringer back-to-back" test method was used by Consolidated Vultee to obtain the yield point in compres-

the Compression Properties of Sheet Metal

By K. R. Jackman

Chief Test Engineer,
Consolidated Vultee Aircraft Corp.

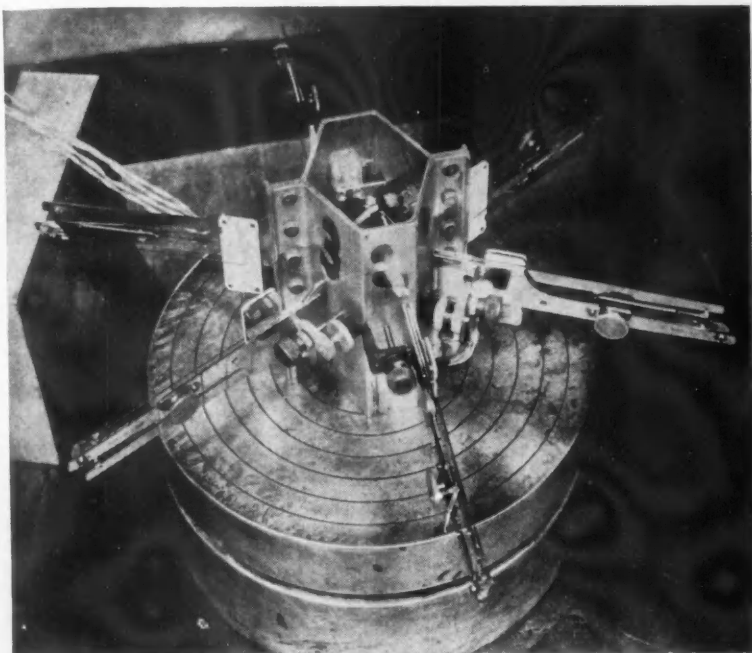


Fig. 4—Installation of extensometers on conventional "dout hat" compression specimen 5 in. long.

tion of aluminum-alloy material. A portion of the stringer under test was cut into sections from 3 to 5 in. long. These were riveted together in pairs, and the ends were ground flat and parallel. All "stringer back-to-back" coupons were processed in the same manner as the basic specimen.

Later a simplified version of the NACA "pack" and the Vega Aircraft "roller" test methods was developed in the Consolidated Vultee Test Laboratories, and was first successfully applied to thin sheet-metal coupons in August, 1942. Each specimen—referred to as a "sandwich" because the 3- by 1-in. test coupon is placed between wood or metal side plates—has two projecting tabs to which the extensometer is attached. Fig. 1 shows the dimensions of the standard compression coupon.

The "sandwich" coupons can be blanked from the basic flat sheet as easily as the standard tensile coupon, both of which are shown in Fig. 2. The ends of these

"sandwich" coupons can then be rapidly gang-milled or ground flat and parallel in groups of ten or twenty.

The specimens were tested flat-ended in the Consolidated Vultee Aircraft Corp. 120,000-lb, 200,000-lb, or 400,000-lb Baldwin-Southwark hydraulic testing machine, an appropriate scale being used. Where the edges were not accurately parallel it was found advisable to insert a spherical-seat bearing block under the specimen, as shown in Fig. 3.

The compression deformation of each specimen was determined by one or another of the following three methods: (1) by 1000:1 Huggenberger tensometers attached to the backs of the two "hats," Figs 3 and 4; (2) by Celstrain gages (Convair electric wire strain gages) attached inside or outside the "hats," Figs. 4 and 5, and (3) by any standard tensometer straddling the double flanges of the specimen. Fig. 4 shows the setup for comparative tests on a typical "stringer back-to-back" coupon, Huggenberger gages being applied to the outside of the six faces, and Celstrain Type C-1 gages to the inner faces.

Fig. 5 shows a typical assembly of a metal-faced "sandwich" of light sheet, with a Southwar-Peters 2-in. extensometer attached to the projecting tabs.

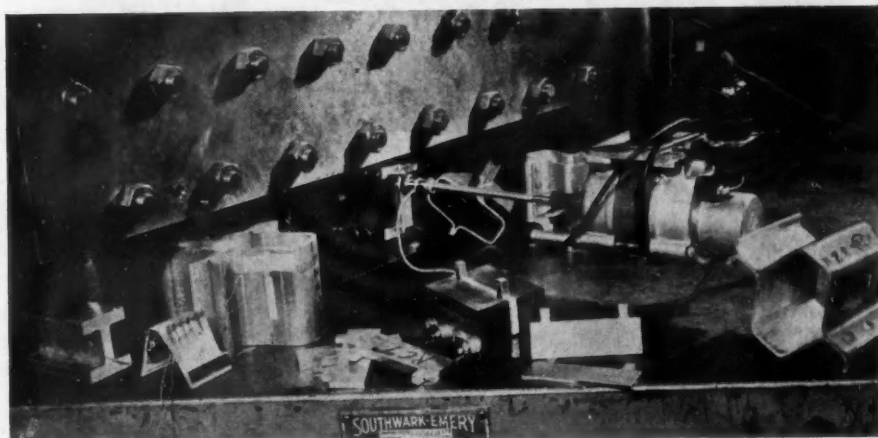


Fig. 5—Southwark-Templin autographic stress-strain recorder.

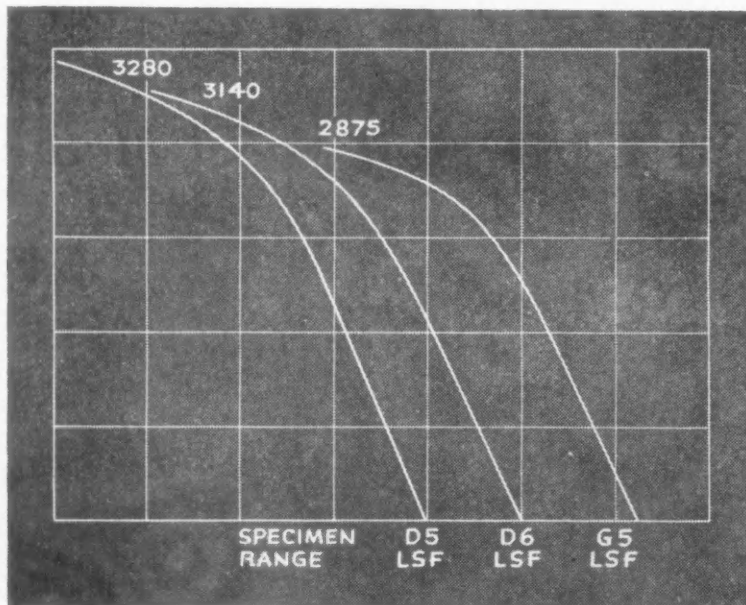


Fig. 6—Sample autographic compression stress-strain records.

As a result of experience gained with the two test methods described in the foregoing, it can be stated that an experienced testing-machine operator can carry through the "sandwich" test on a specimen in from 8 to 10 minutes, after the coupons have been shaped and their ends ground flat a parallel. Strains indicated by the Huggenberger and Cel-strain gages of Fig. 4 showed a surprisingly uniform distribution of load over the cross section of the "double-hat" specimen.

In conclusion it may be stated that the "sandwich" method of determining the compressive yield point of sheet-metal coupons has given accurate and rapid results, and has proved to be well suited to use in production laboratory tests.

The "stringer back-to-back" method is equally accurate when properly applied, but takes several times more time. Either of these CVAC test methods is several times as rapid as the Vega "roller" method or the NACA "pack" method. Use of the autographic stress-strain recorder on the "sandwich"

(Turn to page 82, please)

Any other 2-in. extensometer would have been equally satisfactory, except for the fact that the Southwark-Templin autographic stress-strain recorder shown in Fig. 5 produces a permanent record. Greased hardwood blocks, tightened by wing nuts, gave accurate results. Shown in the foreground of Fig. 5.



Britain's Biggest Armored Car

BRIEF particulars have been released in England regarding the AEC armored car, the largest and most heavily armored and armed of British vehicles of this type. Designed by the Associated Equipment Co., manufacturers of the great majority of London buses, it is being produced at several plants in England. The power unit is a Diesel oil engine developing 153 bhp at 2000 rpm, giving it a maximum speed of 42 mph on roads and 18 mph across country.

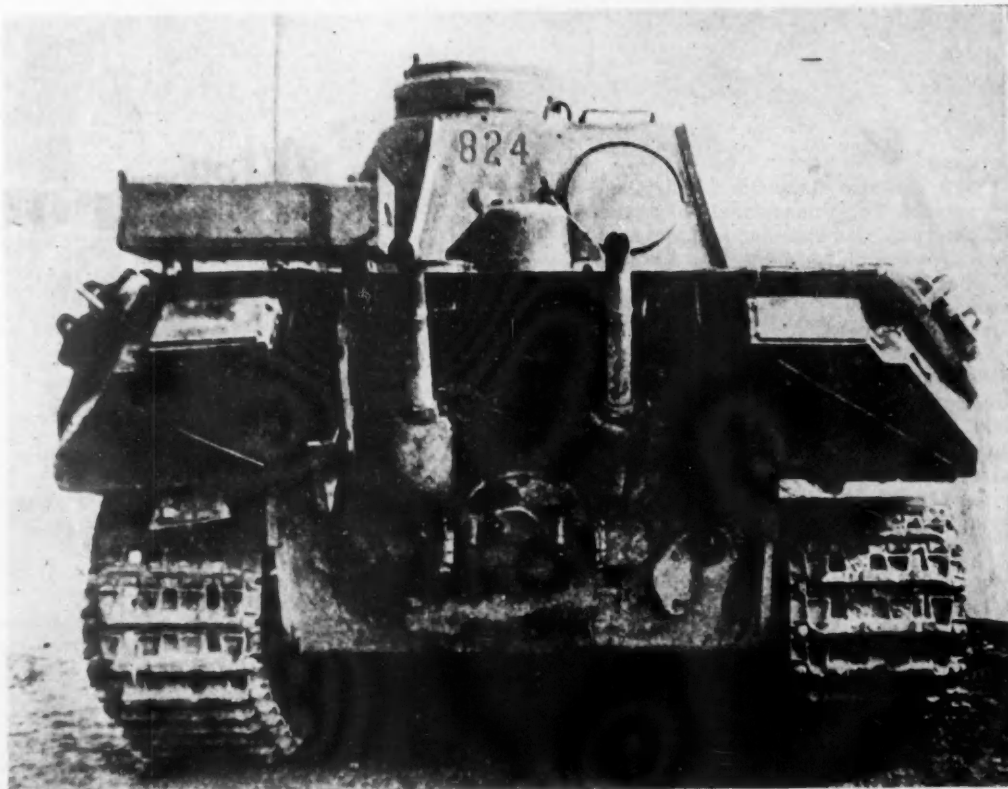
The armament consists of a six-pounder anti-tank

gun is an electrically operated turret capable of full circle rotation, a 7.92 mm Besa machine gun mounted co-axially with the six-pounder, and a light anti-aircraft machine gun on top of the turret. Armor is 1¼ in. thick at the front and 1 in. at the sides. The total weight, including standard radio equipment, is 28,250 lb. Tires are of the "run flat" type. The crew of four consists of the commander, driver, gunlayer and loader, the latter also serving as radio operator when required.

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This rear view of the Panther tank shows the exhaust pipes of the V-12 engine. The extra wide tracks are of new design. (British Combine photo)



Nazi Panther Tank



The main armament of the Panther tank is a 75-mm high velocity gun having a total length of about 18 ft. (Mark VI has an 88-mm cannon). Alongside it in the turret is a 7.92-mm machine gun, but no machine guns were found in the front of the hull as has been the custom in other German tank models. The thickest armor measures about 4 in. and is found on the gun mantlet. The side armor is about 1 1/4 in. thick. Spare tracks are hung on the sides for added protection. (Acme photo)



One of the latest pieces of German combat equipment is this Panther (Mark V) tank, which was used for the first time in Russia. The sloping front is new in German tank design. Reported to weigh 45 tons, the Panther is powered by a 650 hp V-12 engine, the same power plant installed in the German Tiger (Mark VI) tank, as also are its transmission, suspension and tracks. The Mark VI tank weighs about 65 tons. (Acme photo)

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RIES

New Production

TYPE and size standards of air gage spindles for dimensional inspection of internal diameters and bores have now been established by The Sheffield Corporation, Dayton, Ohio. At present, standards have been set up on "Precisionaire" spindles for checking either "through" or "blind" holes ranging in diameter from .300 in. to 1.734 in., with tolerances from .005 in. to 50-millionths and less. All spindles within certain size ranges may be used on Precisionaire instruments of corresponding tolerance range. Additional standards are being prepared.

Four types of standard spindle as-



Representative components of Precisionaire standards

semblies are available. Type "A" or "A-1" assembly is used where the gage is presented to the work and consists of spindle, extension shaft, handle and hose. Type "A" is designed for checking "through" holes and type "A-1" for blind and counterbored holes. Type "B" or "B-1" is used where work is presented to the gage and consists of spindle and adapter. Type "B" is used for checking "through" holes and type "B-1" for blind and counterbored holes.

THE Model AG-8 wet belt surfer, just put on the market by the Porter-Cable Machine Company, Syracuse, N. Y., features extremely rigid construction and large coolant capacity. The self-contained recirculating pump holds 35 gal of coolant. Other new features of the machine include a readily accessible waste clean-out drawer; new "joggle" type switch for easier tracking of belts; higher table for greater convenience to operator; flexible tube to provide "spot" coolant where it is needed in greater quantity and greater platen grinding area.

Type AG-8, which is illustrated, is used for grinding steel, aluminum, bronze, magnesium, glass, plastics, fiber, hard rubber, ceramics, etc. Such hazards as heating, warping, discoloring, flowing and chipping of material being ground are said to be completely eliminated.

MACHINE PRODUCTS CORPORATION, Detroit, Mich., has brought out two new Rotabs—a 12-in. and a 24-in. size. The 12-in. size is particularly adapted to milling operations and lends itself to easy mounting on the table of a milling machine. This small model has a rotating table to which the work is clamped. The table can be turned to any degree and can be made to assume any position radially in addition to permitting its plane to be fixed to any angle from the vertical to the horizontal and even to a position 30 deg in the opposite direction without disturbing the initial clamping of the work. The 12-in. model weighs 125 lb.

The 24-in. model can be adapted to a wide range of milling and boring operations. Its weight is listed at 688 lb.

Both models have dials showing degree and minute graduations which register the angle of setting. An adjustable degree ring is under the face plate to avoid excessive turning of the handwheel to obtain the zero setting. A sine bar is furnished to provide greater accuracy on angular settings. The tables may be locked at any desired position and can be disengaged to rotate freely by hand.



Rotab rotary table

THE Keller pneumatic ratchet wrench, made by the Keller Tool Company, Grand Haven, Mich., is designed for difficult nut-running in close quarters. Double strength in the pawl is accomplished by building it with two ratchets

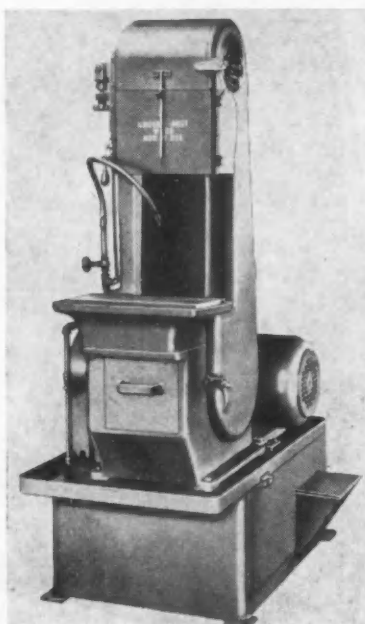


Keller pneumatic ratchet wrench

engaging the teeth of the socket, and with two compression springs for balanced pressure at point of contact with the ratchet. The tool is available in three sizes with sockets for use on nut-running jobs from 1/4 in. to 3/4 in., all tools having a head clearance not exceeding 1/2 in. Sockets are broached through, so that by turning the wrench over, it can be used for removing nuts as well as tightening them.

THE special-purpose machine for tapping aircraft engine cylinder heads, designed and built by Snyder Tool and Engineering Company, Detroit, Mich., is made with varying numbers of tapping units and various combinations of single and multiple spindle heads, depending upon the requirements of the specific job.

With the ball-bearing mounted fixture table in the forward loading position, the work part is located by plungers entering rockershaft holes and is clamped by means of a cam-action



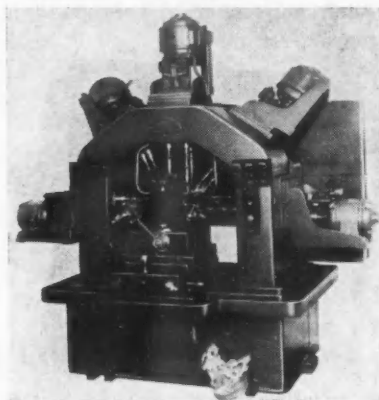
Porter-Cable model AG-8 wet belt surfer

Equipment

lever. While fixtures and table are in this loading position the safety limit switch cannot be closed and therefore, the machine cannot be cycled. The entire fixture and its slide are then rolled into working position, located by an index pin entering the table and locked in place. This action closes the safety limit switch and permits the tapping units to be sent through a working cycle.

The tapping units are developed for individual lead screw tapping and consist of two parts—the motor mounting bracket and the first reduction gear unit, including limit switches and controls. That part of the unit is identical in all cases, regardless of the number of tapping units on the machine. The head on any tapping unit may carry one, two, three or four lead screw spindles, depending upon requirements.

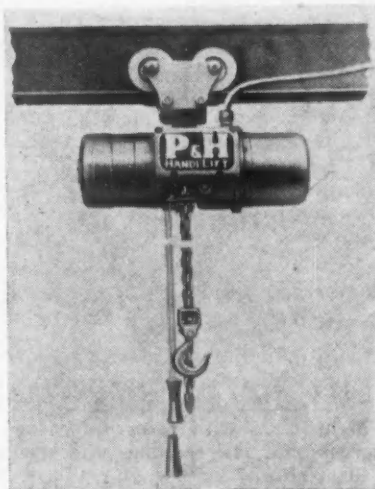
The lead screw spindles are hardened and ground sleeves operating in Ampeco



Snyder special-purpose tapping machine

bronze bushings which are adjustable to compensate for wear. Machine base and column are welded steel. Coolant tank is in the rear and is equipped with a motorized coolant pump.

DESIGNED for users preferring chain hoisting, the small "Handi-Lift" electric chain hoist recently added to the P&H line of the Harnischfeger Corporation, Milwaukee, Wis., introduces several new features into the low price electric chain hoist field. Increased utility is claimed for the "Handi-Lift"

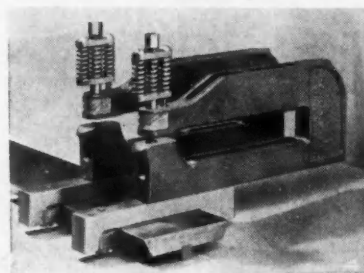


Handi-Lift electric chain hoist

by quick interchangeability to bolt, hook or trolley mounting, with change-over requiring the loosening of one bolt only. Also, in trolley service, it can be suspended either parallel or crosswise to beam for greater flexibility. Fully enclosed construction permits use under any condition of weather, dust, moisture or acid fumes. While the unit is rated at 500 lb, a genuine hoist motor supplies high reserve capacity. The chain is proof-tested for 1800 lb. Operation is by pull cord actuating a lever toggle arrangement, which leaves one hand free to guide the load. The chain wheel, which is forged of high carbon steel and heat-treated, is splined to the drive gear. Over-travel of hook at both upper and lower limits is prevented by a zinc die cast safety limit stop which also actuates control for raising and lowering loads. Dual braking is provided by a large spring-set electric motor brake which automatically releases when hoist is operated and sets instantly with shut-off current. Lowering control is by dynamic means supplemented by the spring set brake which* holds the load, should current fail.

WALES Type BC hole punching units are the latest addition to the line of punching units offered by the Wales-Strippit Corporation, North Tonawanda, N. Y.

These BC units are designed to punch

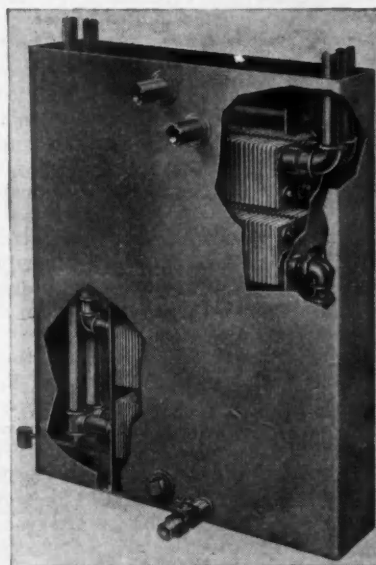


Wales Type BC hole punching units

an unlimited number of straight line, scattered and staggered hole patterns with varying center-to-center distances. Square sheared and curved sheets and long strips of flat material may be perforated with these units in short as well as long runs on a production basis.

A group of Wales Type BC units may be used interchangeably in press brakes and stamping presses by mounting on T-slotted plates, templates and rails. After a pattern has been run, the same group of units may be used in another hole punching pattern.

AN IMPROVED air cooling unit, or after cooler, has been placed on the market by D. J. Murray Manufacturing Company, Wausau, Wis. This new Murray after cooler can be furnished as a unitary structure, the capacity of which may be varied to meet the different operating conditions in a plant. It operates in cooperation with the discharge line of any air compressor, functioning automatically to both effectively cool the air and remove the condensation. It may be used also as an interstage cooler for multiple stage compressor systems.



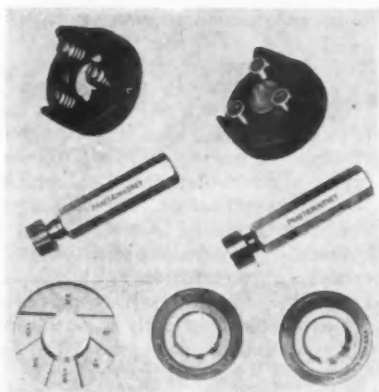
Murray air cooling unit



Products for Aircraft

Gages for Checking ANPT Pipe Threads

The rigid specifications set up by the Army and Navy covering aeronautical pipe threads are said to be fully met by a line of gages now offered by Pratt & Whitney, Division Niles-Bement-Pond Company, West Hartford, Conn. These gages will give a rapid, accurate check on pipe threads made to the latest Army and Navy aeronautical pipe thread specifications known as Spec. An-GGG-P-363, Amendment No. 2, Symbol ANPT. The new Pratt & Whitney gages are made in a complete line.



Pratt & Whitney gages for checking both internal and external ANPT pipe threads. Gages at bottom of cut are for alternate method of checking only external ANPT threads

For checking the accuracy of internal threads there is the double-end gage, carrying the L1 and L3 thread plug gages with check lead, form, diameter and taper. These are followed by a plan taper plug gage which checks taper, roundness and minor diameter. The L1 and L3 plugs have three steps for classifying the thread, while the plain taper plug has six.

For checking external threads there is a set of two special ANPT Tri-Roll gages. The first is a tri-roll thread gage which checks the lead, form, taper and pitch diameter. Three steps on the top of the gage classify the thread. The second is a plain taper tri-roll gage for checking taper and diameter of threads at crest. This has a stepped plunger and three steps on bottom of gage for easily classifying thread. A setting

plug is supplied with each of these special tri-roll gages.

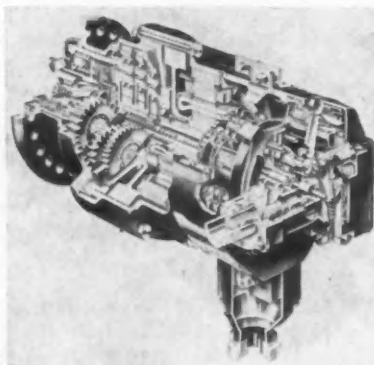
There is an alternate method for checking external threads, approved by the Army and Navy. It employs a set of three ring gages which Pratt & Whitney also can supply. They are L1, or thin thread ring gage, the L2, or thick thread ring gage. These give the same check as the tri-roll method described above, but require more time in use.

Starter for Large Aircraft Engines

Eclipse-Pioneer Division announces a new aviation engine starter for high speed cranking of engines in the 1200-2500 hp class with reserve for larger engines that may become available up to 3000 hp.

The Series 48 starters provide four methods of cranking to meet all operating contingencies: (1) Combination inertia and direct-cranking for normal operation; (2) direct-cranking alone for warm engine starting; (3) inertia cranking alone when batteries are low; (4) hand cranking for emergencies.

During normal operation with a nominal engine cranking torque of 400 lb ft, the Series 48 aviation engine starters will provide an initial cranking speed of 115 rpm followed by direct-cranking of 60 rpm. They are available for one-wire, 24 volt d-c operation, either clockwise or counterclockwise rotation, with 3 or 12 tooth jaws. The high-speed, heavy-duty electric motor accelerates the precision-balanced flywheel to its normal operating



Eclipse Series 48 aviation engine starter

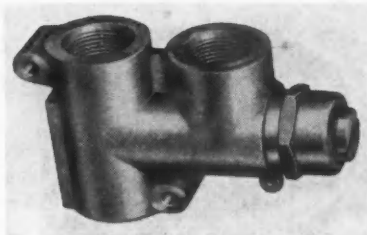
speed of 24,000 rpm, storing nearly 16,000 ft lb of energy and provides for direct cranking after the flywheel energy has been spent.

The starter incorporates a built-in meshing solenoid for automatic control of starter jaw engagement and a preset friction disc, overload clutch, sealed against entrance of engine oil, to protect the starter from undue loading or engine backfire.

The starters are of compact, concentric design weighing 42½ lb with a 6-in. mounting flange and 43½ lb with a 7-in. mounting flange. They measure 6½ in. in diameter and 12½ in. from the mounting flange to the back head.

Relief Valve for Hydraulic Systems

A new relief valve for airplane hydraulic systems has just been brought out by Pesco Products Company, Cleveland, Ohio. This valve was designed for chatterless operation and minimum pressure fluctuation. It is spring-loaded, with external pressure adjust-



Pesco relief valve

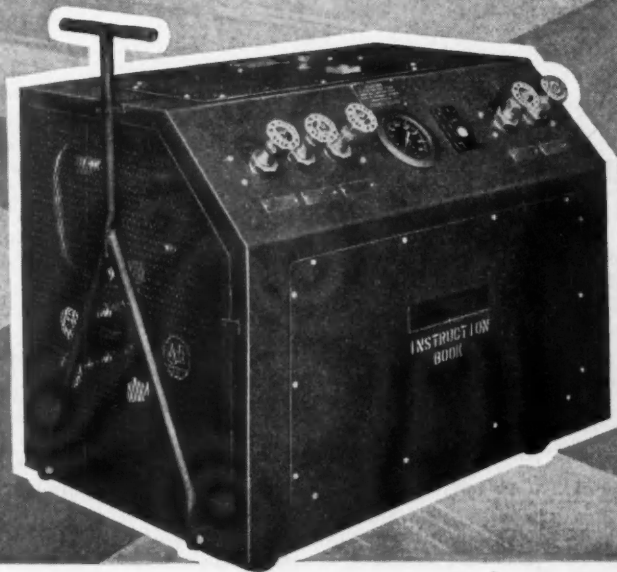
ment to provide pressure regulation control. Pressure range is from 1000 to 2100 psi. Several sizes, with varying capacities ranging from 1.2 to 6 gal per minute, are available. The valves meet AAF winterization requirements and are suitable for use with any common aviation hydraulic fluid.

Improved Gun Turret Control Grips

P302 and P303 gun turret control grips, based on an original design by The Glenn L. Martin Company, were improved in design and are now being manufactured as complete assemblies by Plastic Manufacturers, Inc., Stamford, Conn.

(Turn to page 87, please)

HydrOILics BLOCK OUT THE SHADOW OF DOUBT



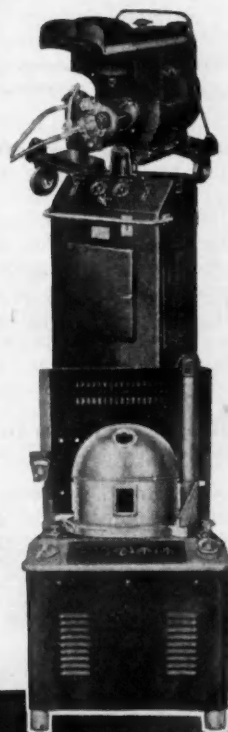
They check flying performance before flight

✓
WING FLAPS
AILERONS
RUDDERS
LANDING GEAR
PROPELLERS
BOMB BAY DOORS
SPARK PLUGS
MAGNETOS
OIL FILTERS

When HydrOILic Test Stands are on the job, shadows of doubt about a plane's fitness for flight are banished. The unit above, for example, checks the hydraulic system which transmits power to ailerons, elevators, wing flaps, rudders, landing gear, bomb bay doors and other hydraulic controls. Tests are made by simply connecting the tester to the hydraulic system — where it substitutes for the plane's engine and hydraulic pump.

Where suitable electrical connections are not available, the gasoline-engine-powered unit at right (top) makes the same tests. The center unit tests aircraft spark plugs, and the lower unit checks magneto performance. Other HydrOILic Stands check oil filters, propellers, etc.

The flexibility of fluid power, and the exact control it ensures, have brought technical advances in this and many other phases of aviation. HydrOILics may have a better answer to your needs . . . your inquiry will be welcomed.
THE DENISON ENGINEERING COMPANY
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June 1, 1944

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43



Felt Transmission Cover Weather Pad

A new bonding technique makes it possible for felt to replace rubber in a transmission cover weather pad manufactured by the American Felt Co., Glenville, Conn., for jeeps and other military vehicles. Two felt pieces (S.A.E. F-13), cut to exact specification, are permanently bonded together

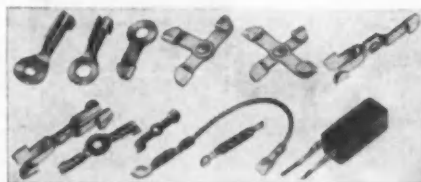


Transmission cover weather pad made by American Felt Co.

and treated with Aerofelt (Type F) to make the part completely waterproof. By the application of this new bonding principle, felt is efficiently and economically substituting for rubber and other materials in a number of intricate parts. The weight saving feature of felt is another advantage which recommends Aerofelt, especially to the automotive and aviation industries.

Solderless System for Wire Connections

A complete system of solderless knife-disconnect splicing has now been developed by Aircraft-Marine Products, Inc., Harrisburg, Pa. The system incorporates throughout the basic design



Knife-disconnect terminals

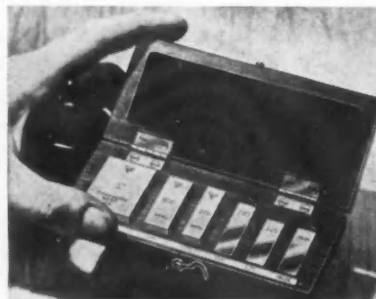
of the manufacturer's splicing terminal in which identical ends are put into 4-point electrical connection by knife-wiping action. The connection is maintained until intentionally taken apart.

This design has been adapted to "T-Link," "Y-Link," "H-Link" and "Cross-Link" applications, and to stud tabs, jumpers and small electrical assemblies such as switches, relays, etc. Other applications are being designed to specifications.

Chrome Plated Gage Blocks for Toolmakers

A personalized set of chromium-plated gage blocks for toolmakers who want their own individual set of standards for checking purposes is offered by the Dearborn Gage Company, Dearborn, Mich.

This gage block set is said to be the first toolmaker's set to be offered with chromium-plated gaging surfaces for



Dearborn Gage Blocks

longer wear. Each set consists of six blocks in the following sizes: .0625, .125, .250, .375, .500 and 1 in., contained in a walnut case.

New du Pont Adhesive

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., which last August introduced adhesive "77" for the production of weather-proof paperboard shipping containers, has brought out a companion adhesive that is said to reduce the box-maker's operative costs.

The new adhesive—listed as du Pont adhesive "78"—contains all of the qualities of the water-soluble vinyl resin "glue" introduced last year. Board made with the new adhesive meets the rigid government specifications for weatherproof shipping containers.

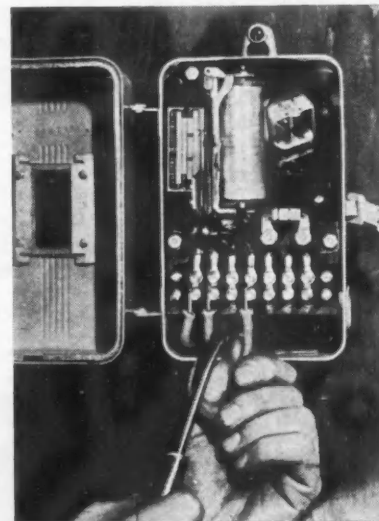
Containers utilizing either adhesive can be fashioned on standard box-board machinery which may be operated at full speed without any special equipment. Both "77" and "78" adhesives are stable, dry white powders that can be simply prepared in standard mixing equipment.

Electronic Relay

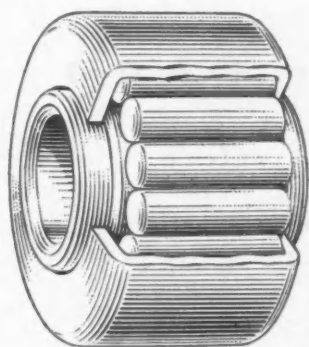
A new electronic relay for amplifying the very limited current transmitted by delicate control contacts or high resistance circuits, thus increasing the application range of many control devices, has been added to the line of relays made by the General Electric Company, Schenectady, N. Y. Operated by any material having a resistance up to 500,000 ohms, or even greater if necessary, the new relay is said to be especially suitable for controlling liquid levels in tanks and boilers, sorting metallic parts by size, detecting broken threads in textile machines, and as a limit switch requiring extremely light pressure to operate.

Small and light in weight, the new relay consists of a standard type electronic tube, a supply transformer and an electromagnetic relay—all mounted in a totally enclosed, weather-resistant enclosure suitable for wall or machine mounting.

In operation, the electromagnetic relay in the device is kept energized as (Turn to page 88, please)

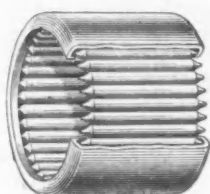


General Electric electronic relay



TYPE PN

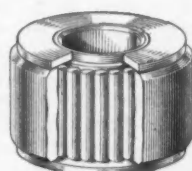
Here's Another New Needle Bearing in The Torrington Line



TYPE DC



TYPE FDT



TYPE AT



TYPE NCS



TYPE RC

THE PN TYPE NEEDLE BEARING, DESIGNED PRIMARILY FOR AIRCRAFT PULLEYS, OFFERS INTERESTING ADVANTAGES IN OTHER THAN PULLEY APPLICATIONS

The most recent addition to the types of Torrington Needle Bearings currently available is the PN Needle Bearing designed for aircraft pulley applications.

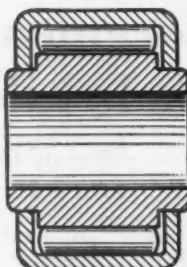
Utilizing the Needle Bearing principle of a full complement of small diameter needle rollers, this new addition to the Torrington line offers the same basic advantages as the other types: high radial load capacity, light weight, compact size, efficient lubrication, ease of installation, and, of course, gives the desired ease and "feel" of anti-friction operation.

Standard (Army and Navy Specification AN-FF-P-796) Aircraft Pulleys equipped with the PN Type Torrington Needle Bearing are currently available. They offer plane builders another opportunity to utilize the same advantages which have made Torrington Needle Bearings so widely used by the industry, particularly in aircraft control applications.

Other Applications Foreseen

The sturdy construction and simplicity of the design of the PN Type Needle

Cross-section shows detail on the PN Type Torrington Needle Bearing. Full complement of rollers eliminates danger of stress concentration. "Cup" design of outer raceway aids efficient lubrication.



Bearing, as illustrated in the accompanying x-section, suggests that it will find many uses in applications other than aircraft pulleys where a compact, high capacity, low cost anti-friction unit can be employed. It is installed by a simple press-fit into the outer "housing" and

the bore of the inner race fits directly over the shaft or axis.

If you are interested in either Needle Bearing equipped aircraft pulleys or in the application of the new PN Type Needle Bearing for other uses, our engineering department will gladly provide more information. Further data on the features and advantages of this and other types of Torrington Needle Bearings will be found in our Catalog No. 107 available on request. Write for your copy today.

THE TORRINGTON COMPANY
Established 1866 • Torrington, Conn. • South Bend 21, Ind.
"Makers of Needle Bearings and Needle Bearing Rollers"

New York	Boston	Philadelphia
Detroit	Cleveland	Seattle
San Francisco	Chicago	Los Angeles
Toronto		London, England



TORRINGTON NEEDLE BEARINGS

Large Increase in Demand for Heavy Artillery and Ammunition

Automotive Industry Receiving Additional Contracts for High Explosive and Anti-Aircraft Shells

Increasing military emphasis on heavy artillery and ammunition in the 155-mm size and upwards has been reflected in recent contract boosts to the automotive industry. Output of heavy field artillery ammunition 155-mm and up, ran 18 per cent ahead of schedule in March in anticipation of a boost in Army requirements. Commenting on this development in his monthly production report, Donald M. Nelson, chairman of WPB, said:

"Battle experience in Italy has indicated a far greater expenditure of ammunition than was originally expected. Requirements for spare gun barrels for 155s, 240s and 8-in. guns are also slated to be increased. The programs are now given maximum priority assistance."

In line with this development, Oldsmobile Division of GM has received a DPC contract for \$4,723,500 for alterations to buildings and installation of new equipment at Lansing, Mich., for production of 155-mm high explosive shells. Oldsmobile's previous assignments have included 75-mm H. E. shells, 90-mm and 4.7-in. anti-aircraft shells, 75-mm armor-piercing shot and 105-mm and Navy 3-in. shells. However, the 155-mm is the largest size yet produced. Pontiac Motor Division of GM has received a \$3,421,000 DPC contract for alteration and rearrangement of buildings to manufacture high explosive shells. Chrysler Corp. has been awarded a DPC contract for \$3,071,000 for additions to the Highland Park, Dodge Main, Chrysler-Jefferson and Plymouth plants in Detroit totaling 499,940 sq ft for manufacture of undisclosed ordnance items.

The Army has set aside \$20,000,000 and the Navy \$15,000,000 for the manufacture of new and highly secret rocket weapons and rocket ammunition. Some of these contracts have been placed in the Detroit area. The manually operated "bazooka" is the best known of the rocket weapons revealed so far. Rocket guns also have been mounted upon "ducks" in amphibious operations in New Britain, and fighter planes and dive bombers in that area recently carried rocket guns in groups of three under each wing to destroy a concen-

tration of Japanese barges at Rabaul.

Nash-Kelvinator Corp. will become the third manufacturer of aircraft engines to go into production of the new and more powerful R-2800-C version of the Pratt & Whitney Double Wasp engine. Pratt & Whitney Aircraft Corp. of Missouri already is producing this engine, which develops upwards of 2100-hp, at a huge new plant in Kansas City, Mo., while Chevrolet Motor Division is preparing to change over its plant at North Tonawanda, N. Y., to make this engine. Nash has been producing the Double Wasp R-2800

engine with a two-stage mechanical supercharger at its Kenosha, Wis., plant. Nash has received a DPC contract for \$9,500,000 for additional plant facilities at Kenosha coincident with the change, upping the total contract to \$46,000,000. Nash also will undertake the manufacture of four-blade Hamilton Standard hydromatic propellers for the Navy at its Lansing, Mich., plant. Both the new engine and the new propeller will be installed in Navy fighter planes, the F4U Corsair and the F6F Hellcat, to give them greater speed and rate of climb.

Eastern Aircraft Division of GM, a producer of planes for the Navy, has turned out more than 4400 Wildcat fighters and TBM Avenger torpedo bombers from its plants at Linden and Trenton, N. J., according to Admiral Ramsey. Eastern Aircraft is now in production on the FM-2, a new version

(Turn to page 52, please)

Foremen's Strike in Detroit Made Idle 55,000 Other Workers

One of the Most Serious Setbacks the AAF Has Received Since Its Inception, According to General H. H. Arnold

Despite an NLRB decision which could be interpreted as favorable, 3,300 members of the Foreman's Association of America continued their strike in 14 Detroit plants until Gen. H. H. Arnold, chief of the Army Air Forces, described the strike wave as "one of the most serious setbacks the AAF has received since its inception" and condemned the strikers for holding up production of vitally needed war planes. Gen. Arnold spoke before a meeting of the National WLB in Washington, to which had been summoned Robert H. Keys, president, and 10 members of the executive board of the FAA. The board voted to end the strike an hour after Gen. Arnold spoke.

The 20-day strike began in the Conner Ave. aircraft plant of the Briggs Mfg. Co. due to an accumulation of grievances and eventually spread to 13 other plants, making idle 55,000 production workers as well as the foremen and costing more than 500,000 man-days of production. The protested departmental transfer of a Hudson Motor Car Co. foreman caused 600 foremen in six plants to follow the Briggs walkout three days later. W. H. Davis, chairman of the WLB, appealed to the strik-

ing foremen in a series of telegrams asking them to return to their jobs, but Keys refused, saying that the employers would not bargain or settle grievances and the WLB would not assume jurisdiction. Nine hundred foremen at the Packard Motor Car Co. and 430 at Murray Corp. of America joined the spreading walkout two days after the Hudson foremen struck. The Packard foremen voted to strike because the company refused to recognize them as bargaining agents despite the fact they had won an NLRB election in February, 1943, while the Murray Corp. strikers were protesting the discharge of six foremen.

Eleven days after the strike's inception, the NLRB handed down a decision in the case of the FAA against the Soss Mfg. Co., Detroit, and the Republic Steel Corp. granting foremen the right under the Wagner Act to join a union free from discrimination. However, it upheld the Maryland Drydock decision of a year previously by holding that organizations of foremen are not properly constituted bargaining units. Thus foremen are free to organize as long as they do not affiliate with

(Turn to page 54, please)

"The efficiency of lathes has increased so greatly we replace old types quickly. In measuring efficiency, we find L & S Lathes pay dividends first."

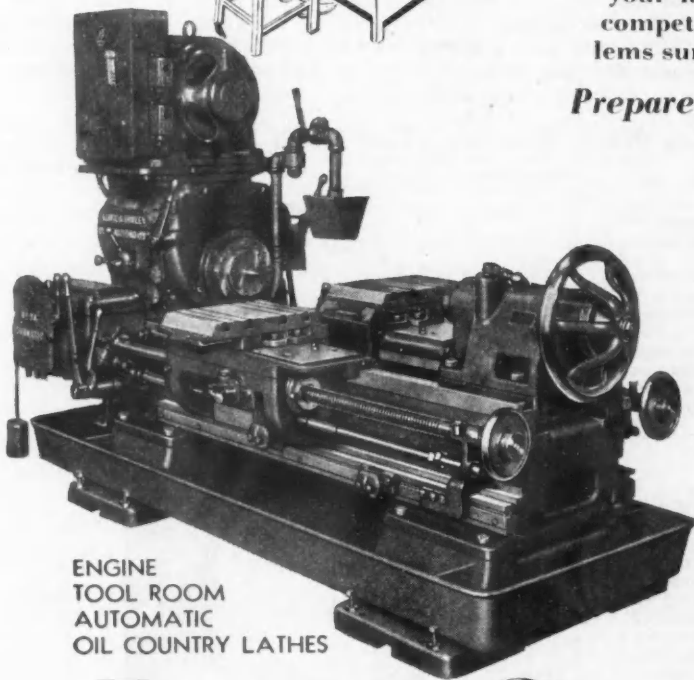


UNDER the stress of wartime production you may not have had time to thoroughly analyze the quality and quantity of lathe output in your shop. Production lathes in continuous use for several years become a liability under three shift operations, unskilled handling and increasing down-time. Add lowered output, failing accuracy, mounting costs and upset schedules—and you have a bad condition, bound to grow worse if neglected.

Check over your production sheets with Lodge & Shipley Engineers. Find out in actual dollars and cents the economies you can make by replacing old, worn lathes with new and better ones. Our experts can show you, too, how L & S "engineering foresight" will make your lathes adaptable to the new competitive and production problems sure to come.

Prepare for the Coming Battle of Markets!

When competition grows keen, new and better machine tools will be the chief factor in holding costs to a competitive level. Lodge & Shipley, with 52 years of specialized lathe experience, can give your turning operations the "short cut" to lower costs. Save later by planning now!



ENGINE
TOOL ROOM
AUTOMATIC
OIL COUNTRY LATHES

The No. 3-A Duomatic (illustrated) is a full automatic lathe permitting dual operations—front and rear—for quantity production of work. With the 3-A Duomatic any combination of turning, straight or angular "in" or "out" facing cycles are obtainable, front or rear, singly or together. Diameters and lengths are automatically controlled, insuring exact duplication of sizes. The 3-A Duomatic handles a wide variety of work in large or small quantities with equal efficiency. Write for Bulletin 601 FL for complete data.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, 25, OHIO, U. S. A.



Raw Steel Output in Excess of Some Mills' Theoretical Capacity Forecast

Strengthening of Reserves Appears to Be the Objective of Procurement Officers of Armed Forces

By W. C. Hirsch

War demand on steel producers' facilities continues so exigent that raw steel output in excess of some mills' theoretical capacity is forecast for the first half of June. Whether the heavy caliber shell steel program, now under way, is solely responsible for this, is difficult to say. It is assumed in the steel market that the procurement officers of the armed forces are keenly aware of the lag between commitments and deliveries, and that the strengthening of reserves rather than immediate needs is the objective. It is pointed out that the production of shell steel calls for slow cooling and other processes that tend to act as a brake on daily tonnage output. Much steel is also reported to be needed for the 8-in. gun program, now in its initial stages. The American Iron & Steel Institute's customary revision of production figures shows that March steel production, revised to 7,820,226 net tons, topped all previous monthly records, that of October, 1943, with a revised output of 7,814,117 tons being the runner-up.

The Combined Raw Materials Board has issued the following statement on the international copper situation: "Early this year, the British copper position had eased sufficiently for the United Kingdom to plan reducing its purchases of copper from Northern Rhodesia and other sources of supply. The United States position, however, has continued to be tight and this situation has been worsened by the prospective decline in United States copper production because of manpower shortages. The whole questions of copper supplies in 1944 has been under review by the Combined Raw Materials Board and it has been decided that, in order to safeguard the Allied Nations' copper position, production from all sources should be maintained as far as practicable. Any production from sources hitherto allocated to the United Kingdom in excess of that country's agreed requirements will be made available in 1944 to the U. S. A. or the U. S. S. R., as may be arranged in agreement with the appropriate authorities of the countries concerned." Uneasiness over the adequacy of copper supplies made itself felt shortly after the issuing of highly reassuring reports early this year. In the absence of an explanation in detail of the causes of this change in attitude, it is thought that both here and in the principal foreign copper-producing countries, labor shortage has progressively impaired output. Allocations here, however, to high priority consumers have not suffered, and restrictions appear to be aimed more at averting premature appetite for copper

of makers of civilian and quasi-civilian products than to overcome inadequacy of supplies for essential military and naval needs.

E. Baliol Scott, in his annual review of the tin situation in the London *Mining Journal* places 1943 production at 130,000 tons, compared with estimates of more than 200,000 tons in the earlier war years. Mr. Scott says 45,000 tons of the 1943 output came from Japanese-occupied territories in the Far East. Of this, he thinks, shipments to Russia, with which country Japan is

not at war, reached 10,000 tons and shipments to Germany by blockade runners 20,000 tons, with no information on how much of this tonnage escaped Davy Jones' locker and Allied guns. The 45,000 tons he estimates that Japan got through occupation, may include a heavy carry-over from previous years' production. Of tin available to the United Nations, this authority credits 40,000 tons to Bolivia, 20,000 tons to the Belgian Congo and approximately 15,000 tons to Nigeria. The Bolivian situation is thought to have improved as the result of the arrival in the South American republic of U. S. Government authorities, authorized to look into existing difficulties and to aid in their adjustment, so that there may be as little gap as possible in the flow of Bolivian tin concentrates to the Government smelter in Texas.

SWPA Issues Regulation for Disposal of Surplus War Property

W. L. Clayton, head of the Surplus War Property Administration, has announced the issuance of SWPA Regulation No. 1 governing declaration of surplus property by the Navy, Army, and the Maritime Commission. Included in the regulation is a list of selling agencies, the locations of regional offices and the Standard Commodity Classification showing what property is to be handled by each selling agency.

The regulation adds three new selling agencies to the five recommended by the Baruch-Hancock report. Agencies now authorized to sell property are: Procurement Division, Treasury;

RFC; Maritime Commission; FWA; FEA; NHA; WFA, and the Navy Department.

Selling agencies will be held responsible for all the property turned over to them. They are to determine methods of sale, the identity of the purchasers and the price, the execution of all documents in connection with disposal.

The Army, Navy and Maritime Commission are permitted to sell termination inventories, and nominal quantities. Also, these agencies which have the duty of declaring goods surplus, may withdraw such property as they desired (Turn to page 56, please)

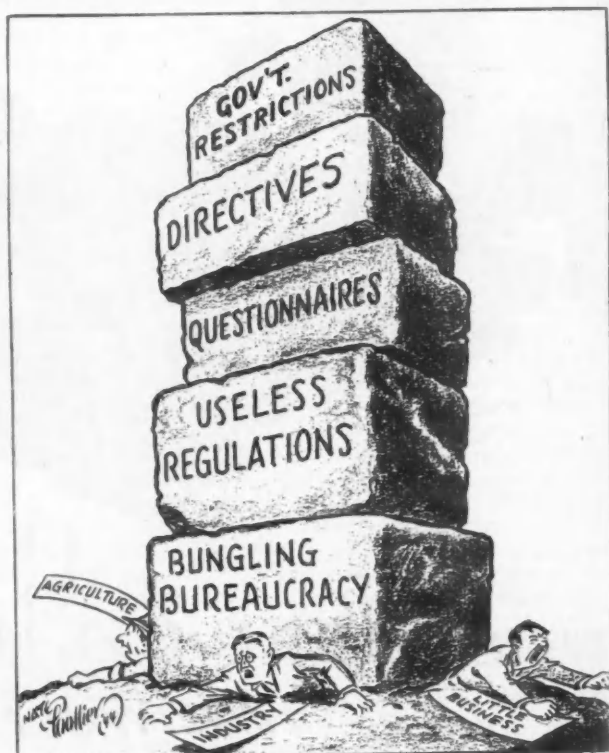
Too Many Bureaus—Too Much Bureaucracy

"I accuse the present (Hoover) administration of being the greatest spending administration . . . in all history. One which has piled Bureau on Bureau, Commission on Commission. Bureau and Bureaucrats have been retained at the expense of the taxpayers."

"The people in America demand a reduction of Federal expenditures. It can be accomplished by reducing the expenditures of existing departments, by abolishing many useless commissions, bureaus and functions, and by consolidating many activities of government."

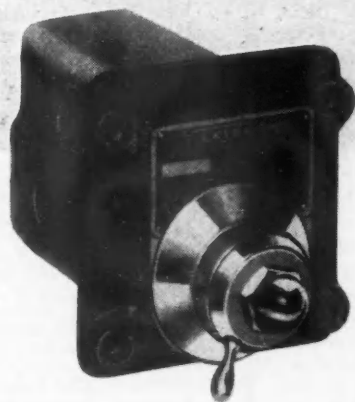
"But remember well, that attitude—the way we DO things—is nearly always the measure of our sincerity."

—F. D. Roosevelt—1932



CONSTANT FLOW RATE

Regardless of
**VARIATIONS IN
FLUID PRESSURE**



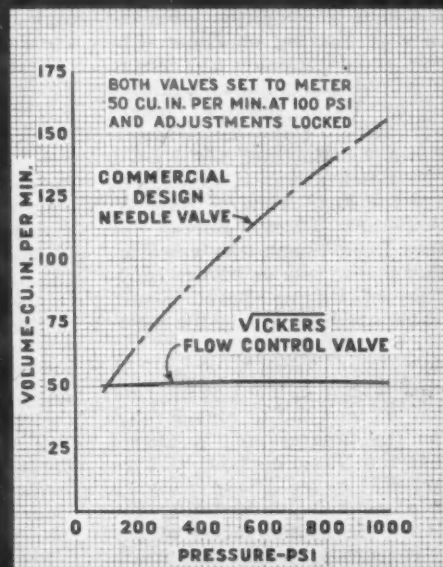
As shown by test chart at right, the Vickers Flow Control Valve maintains a practically constant metering rate (for a given setting of the control adjustment) regardless of variation in fluid pressure. This ability to accurately control the rate of travel of tool head or slide . . . or the rpm of a hydraulically driven work spindle . . . at all times regardless of the resistance encountered is a fundamental requirement of many types of machine tools and special machinery. The absence of a hesitation, jump or a speed variation with a load change is important because these nearly always are detrimental to tool life, work finish or proper operation. Tool damage when "breaking through" work is eliminated and variations in cut or operating pressure have no appreciable effect upon feed rate. See Bulletin 40-15 for complete information.

Vickers Application Engineers will gladly discuss with you how "hydraulics" can be used to your advantage.

VICKERS Incorporated

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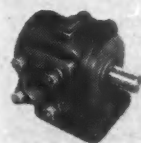
Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES
NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER



All readings taken at constant temperature of 120°
F. with oil having viscosity of 200 S.S.U. at 100° F.

VICKERS Adjustable **FLOW CONTROL VALVES**

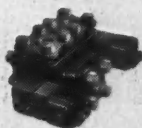
Representative of More than 5,000 Standardized Vickers Units
for Every Hydraulic Power and Control Function



CONSTANT DELIVERY
PUMPS



FLUID
MOTORS



DIRECTIONAL
CONTROLS



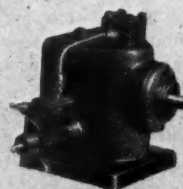
VOLUME
CONTROLS



PRESSURE
CONTROLS



CONTROL
ASSEMBLIES



VARIABLE DELIVERY
PUMPS

SAE Diesel Engine, Fuels And Lubricants Meeting

*Talks by Capt. L. F. Small and W. S. James
Feature Two-Day Meeting Held in Chicago*

At the dinner in connection with the SAE National Meeting on Diesel Engine, Fuels and Lubricants at Chicago on May 17 and 18, a capacity audience was told by Capt. Lisle F. Small, Bureau of Ships, Navy Department, that the war has justified the Navy's process of Dieselization. Capt. Small, substituted for Rear Admiral Earl W. Mills, Assistant Chief, Bureau of Ships, Navy Department, who was originally scheduled to talk on "Some Horizons of Diesel Engine Development" but who was unable to attend the meeting.

This war, Capt. Small said, will be remembered for the millions of internal combustion engines and to considerable extent for the progress in the Diesel field. That the Navy, he said, believes wholeheartedly in the Diesel becomes apparent when it is realized that for the first time the Diesel, so far as the Navy is concerned, leads the steam turbine in horsepower applied to ship propulsion. The curves crossed along about last Fall. Diesel horsepower for ship propulsion is now well over the 25 million mark.

Of particular interest was Capt. Small's analysis of the relative merits of the four and two-stroke cycle Diesel engines. He spoke of the inherent simplicity of the four-cycle engine and its well-known ability to operate with a minimum of attention. "On the other hand," he said, "I must be so bold as to say that the two-cycle Diesel must come, because, gentlemen, whether you like to hear it or not, it is here."

Capt. Small said that the fact that the two-cycle engine has double the number of power strokes, and, therefore, is likely to be lighter and more compact, fortifies it with certain inherent advantages which no doubt accounts for its prominent development to date. He particularly stressed the advantages of the two opposed pistons per cylinder, uniflow scavenging type engine. It was made evident that the direction of possible progress towards higher thermal efficiencies is clearly marked, with present development work on the two-stroke cycle being definitely based on the use of supercharging.

Captain Small also mentioned the Navy's experiences with many of the related items of Diesel design and operation and which, in the morning and afternoon technical sessions, furnished the bulk of the material for the papers presented. These included, for example, the cooling effect of supercharging, heat flow into pistons, better use of fuels, proper lubricants, etc. The speaker also made it plain that he believes that the further use of poppet valves in engines is questionable so far as

high-speed high-output Diesel engines are concerned.

Preceding Captain Small's talk, W. S. James, President, SAE, talked on post-war possibilities of the SAE Diesel Engine-Fuels and Lubricants Activities. Mr. James, stated that the best fuels and lubricants are wasted unless both industry and purchaser profit and cooperate. Planned liaison research operations between the producers of fuels and lubricants, builders and users of Diesel engines will allow the various factions to move forward together more rapidly, said Mr. James. No satisfactory progress has been made by engine makers in the past without proper knowledge of fuels and lubricants. The two great industries have always worked hand in hand and Mr. James predicted that future engineering promises much of value as long as this close liaison continues.

Record attendance featured the morning and afternoon technical sessions of both days. The subjects of the various papers evidently were close to the hearts of engineers present judging from the lively and prolonged discussions which followed these papers of a controversial nature.

Advertising Notes

Charles D. Adams has been appointed associate account executive on the Electric Auto-Lite Co. account by Ruthrauff & Ryan, Inc. He takes over duties formerly handled by E. J. (Jack) Reeser, who has been assigned to the Chrysler account.

Robert Johnson, formerly West Coast representative, has been named to handle publicity on the Dodge Truck account by Ross Roy, Inc.

Obituary

Charles M. Smillie, 82, active in experimental tooling work in the early days of the automobile in the Detroit area, died May 11 at Detroit after a short illness. He established C. M. Smillie & Co. in 1889, one of the first tool manufacturers in Detroit.

Albert Haberer, 42, assistant chief engineer of the Fisher Body Division of General Motors, died suddenly May 14 at his home in Detroit. He had been with Fisher Body since 1917.

John S. Dages, 49, vice-president in charge of sales for Republic Gear Co., died May 12 at Detroit after a long illness. He had been with Republic Gear for more than 20 years.

Emmett L. Page, 59, one-time production manager of the Oakland Motor Car Co., died suddenly May 12 at his

home in Pontiac, Mich. He was an automobile dealer at the time of his death. He was a former president of the Pontiac Chamber of Commerce.

John H. Cunningham, 44, former advertising executive on various truck accounts, died May 16 at Northville, Mich., after a long illness. He was associated with Advertisers, Inc., on the Dodge truck account, with D. P. Brother & Co. on the GMC truck account and with Campbell-Ewald Co. and Lee Anderson Advertising Co. at various times.

Business in Brief

*Written by the Guaranty Trust Co.
New York, Exclusively for AUTO-
MOTIVE AND AVIATION INDUSTRIES*

Narrow fluctuations of general business activity have indicated little net change since February. The seasonally adjusted index of *The New York Times* for the week ended May 6 stood at 144.1, as compared with 145.5 for the preceding week and 140.0 a year ago.

Department store sales, as reported by the Federal Reserve Board, rose from 150 to 165 per cent of the 1935-39 average in the week ended May 6, and the value indicated was 8 per cent above the corresponding figure in 1943. For 1944 to date, the total is 5 per cent greater than the comparable sum last year.

Railway freight loadings during the week ended May 6 totaled 836,978 cars, 1.8 per cent less than the preceding weekly number but 2.5 per cent above the corresponding figure in 1943.

Production of electric power during the week ended May 13 increased slightly; but the total was only 6.8 per cent above the output a year ago, as against a similar excess of 8.5 per cent shown a week earlier.

Crude oil production in the same period averaged 4,502,000 barrels daily, 16,500 barrels below the figure for the preceding week and 17,700 barrels less than the average output recommended by the Petroleum Administration for War.

Estimated production of soft coal during the week ended May 6 was 12,150,000 net tons, 1.7 per cent less than the preceding weekly figure, as compared with 9,930,000 tons in the corresponding period last year. For 1944 to date, output is 4.8 per cent above the comparable amount in 1943.

Engineering construction contracts awarded during the week ended May 11 totaled \$42,209,000, as against \$41,856,000 for the week before, according to *Engineering News-Record*. Contracts so far reported in 1944 show a decline of 51 per cent from the corresponding amount in 1943—private projects registering an advance of 13 per cent, while public construction has dropped 53 per cent.

The Irving Fisher Index of wholesale commodity prices for the week ended May 12 registered a rise of two fractional points to 112.9 per cent of the 1926 average, as compared with 111.8 a year ago.

Member bank reserves increased \$39,000,000 during the week ended May 10, and excess reserves remained at an estimated total of \$800,000,000. Business loans of reporting members declined \$20,000,000 in the same period but stood \$248,000,000 above the total a year earlier.

There are many GOOD THINGS



AHEAD...

Fins applied to the sides of aircraft tires have been found to reduce wear. When the landing gear is lowered, the air pressure spins the wheels and reduces the scuffing of the tires in their first contact with the ground.

The formerly worthless scrub palmetto, which grows like a weed on the Gulf Coast of Florida, is now ready to supply material for wall-board, brushes, binder twine, upholstery, insulation, and for use as a reinforcement for plastics and Portland cement.

A plastic molding powder is being made from potato starch.

Some engineers foresee the time when the refuse of cities—garbage, ashes, paper, etc.—will be removed continuously by underground tubes and burned in large incinerators to furnish power.

Shells are being tested by a new variation of the old trick of dropping a coin on the counter. When dropped on metal plates, the perfect shells make a particular sound that is detected and reported by an electronic "ear".

A fine finish may be put on stainless steel inexpensively by means of a newly patented electrolytic process.

The strength of spot-welded aircraft joints is being successfully tested by X-ray.

Because of its peculiar stretch and slow recovery, as well as its light weight and resistance to rot, Nylon rope is expected to have many post-war uses where a shock absorbing effect is required.

A new flexible tubing is made of woven glass fiber covered with plastic.

A new street cleaner sucks up leaves and compresses them for fertilizer.

A new ignition cable is made of monel and is insulated with synthetic rubber and glass fabric.

Pure tungsten can now be produced directly from the ore by a newly reported electrolytic process.

A patent assigned to a large truck manufacturer permits the conversion of a regular truck to a half-track crawler.

The Office of War Information has an exhibit of new materials, methods, and products in the Social Security Building in Washington.

Echo sounders, intended to measure the depth of water under a ship, are being used to locate schools of fish.

Experiments are being made with alloys of wrought iron and nickel.

Machinery has been designed for the high-speed, mass-production baking of bread with infra-red lamps.

Neon lights will be standardized in 98 colors.

Several manufacturers of air-conditioning equipment are working on plans for a \$1,000 unit suitable for a six-room house.

At least 30 aircraft parts of laminated plastic paper are in production.

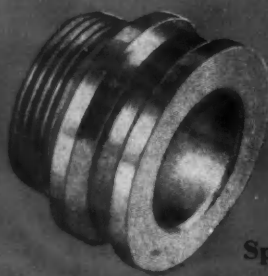
Lamp bulbs are being made shatter-proof by a coating of lacquer.

A new double-barrelled spray gun that can handle two fluids at once has just been patented.

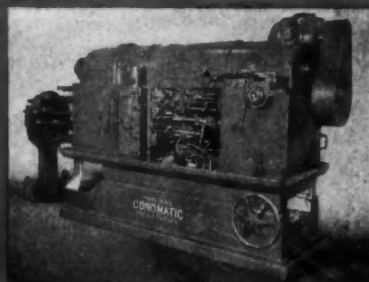
A novel mail box answers audibly any spoken request for the zone number of any address in the city.

When you look ahead

Look at metal cutting costs



This part was produced on an 8 Spindle Conomatic from SAE 4615 seamless tube stock. The 16 machining operations, performed without rehandling, include hole and groove burnishing, threading, and internal recessing. Time—37 seconds. Conomatics cut metal cutting costs.



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.



Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the May 15 issue of AUTOMOTIVE AND AVIATION INDUSTRIES went to press:

CAMFIELD MANUFACTURING COMPANY, Grand Haven, Mich.
DANLY MACHINE SPECIALTIES, INC., Chicago, Ill.
EMERSON RADIO AND PHONOGRAPH CORPORATION, New York, N. Y.
C. E. ERICKSON COMPANY, INC., Des Moines, Iowa.
INDUSTRIAL GEAR MFG CO., Chicago, Ill.
KIMBLE GLASS COMPANY, Vineland Plant, Vineland, N. J.

"E" Star Awards

for continued meritorious services on the production front have been awarded to the following firms:

ALLOY STEEL GEAR & PINION CO., Chicago, Ill.
FARREL-BIRMINGHAM COMPANY, INC., Ansonia, Conn. (three plants).
GENERAL MOTORS CORPORATION, Aeroproducts Division, Dayton, Ohio.

PUBLICATIONS

A new 16-page condensed version of the catalog covering the standard line of Kollsman Aircraft Flight, Navigational and Engine Instruments has been published by the Kollsman Instrument Division of Square D Co. Included in the catalog is a complete listing of current production types, full size dial views of many of the standard instruments and information on several new types.*

A new calculator for determining the welding preheating and interpass temperatures of steels has been announced by The Lincoln Electric Co. The calculator consists of four movable sections of heavy cardboard and has complete instructions printed on the outside sections.*

Vinco Corp., 8855 Schaefer Highway, Detroit 27, has published a new book of Angular Spacing Tables for use in connection with the spacing of teeth in precision gears, splines, index plates, etc. Tabulated is the included angle between any point of beginning and any one or more divisions of a circle up to and including 200 divisions. An appendix, which may serve as a ready reference in making gears calculations, contains tables of Fundamental Dividing Angles in degrees—minutes—seconds, in degrees and decimals of the degree, and in radians; a new type of conversion table for converting minutes and seconds in one reading to decimals of the degree; and another table with which a single reading converts an optional sequence of decimals, hundredths, and thousandths of the second to decimals of the degree. The book is priced at \$10.00 per copy.

The Progressive Mfg. Co. has published a new catalog which shows, in addition to standard items, several dozen drawings of special fastenings which have recently been produced. Tables are included showing the standard weights of machine screws, stove bolts and machine screw nuts in pounds per thousand pieces. Measure-

ment data on all standard items is also included.*

Bendix Products Div. of Bendix Aviation Corp. has issued a new booklet on Bendix Hydrovac, a one-unit vacuum power braking system for trucks, tractors and buses.*

Leeds and Northrup has issued a revised edition of its Micromax rayotube pyrometer catalog. In addition to the engineering descriptions included in the earlier edition, it includes for the first time equipment being used to measure the temperature of molten cast iron, electric salt pots and blast furnace stove domes.*

Fischer & Porter Co. has issued a new, interesting and instructive catalog on the F & P Rotameter, an area-type flow meter for accurately measuring the flow rate of liquids and gases. The catalog is titled A New Era in Flow Rate Measurement and contains 32 pages of the latest information on the Rotameter.*

The Air Reduction Sales Co. has announced the publication of a 20-page revised price list, Gas and Electric Welding Supplies and Accessories. Listed are gas welding rods made in a wide range of metals, types and sizes for all welding requirements, hard-facing alloys, brazing alloys, etc. Detailed information is given on sizes, dimensions, weights, etc.*

Lindsay and Lindsay has issued a new structure truck body folder, describing both the packaged unit truck body service and the Ls Fleet Engineering Service.*

Bulletin 96, by Niagara Blower Company describes its newly-developed Balanced Wet Bulb Temperature Control for the Niagara Aero Heat Exchanger.*

Cannon Electric Development Co. has issued the new Cannon Electric Laboratory and Switchboard Bulletin containing information, photographs, drawings and data on its line of specialty fittings. Catalogued are surface and sub-mounting plugs and receptacles, straight cord plugs and receptacles, switching plugs and experimental switchboards.*

George Scherr Co. has issued a new folder on its Opti-Flat, a new glass optically finished surface plate which is guaranteed flat to .00005".*

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE AND AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

PERSONALS

Bendix-Westinghouse Automotive Air Brake Company has named E. R. Fitch director of engineering; A. R. Leukhardt, chief engineer; F. L. Wheaton, director of sales; A. V. Howe, sales manager; S. Johnson, Jr., manager sales engineering; H. W. Jackson, service sales manager and M. S. Stein, auditor.

Perfex Gage & Tool Co. has announced the appointment of Gilbert Morgan as their representative in the Chicago territory.

Worthington Pump and Machinery Corp. has announced the appointment of Thomas J. Kehane as commercial vice-president, in charge of the Corporation's Pacific Coast activities, with headquarters in San Francisco.

The appointment of Garet W. Denise to be general manager of Littelfuse Chicago Plant operations has been announced by Littelfuse, Inc. He was formerly with Republic Aviation Corp.

W. Ward Jackson has returned to Celanese Celluloid Corp. as head of plastic activities in the Washington office, after two years as Consultant to the WPB Chemicals Bureau.

Royce G. Martin, president of The Electric Auto-Lite Co., has been elected to serve also as chairman of the board of directors of the organization. He succeeds the late C. O. Miniger.

Maurice N. Trainer, first vice-president of the American Brake Shoe Co., was elected a director of the company. He has been president of the company's brake shoe and castings division since 1939.

Announcement has been made of the appointment of R. W. McClellan as special assistant to F. A. Wardenburg, general manager of the DuPont Company Ammonia Dept.

George H. Clark, vice-president in charge of engineering of The Formica Insulation Co., was elected a director of the Society of the Plastics Industry.

Carl I. Collins has been elected executive vice-president and director of Superior Steel Corp.

P. R. Mallory & Co., Inc., has appointed Earl R. Sayre as an application engineer for the company's line of electrical, electronic and metallurgical products.

Norton Co. has made F. W. Lee field engineer in the Philadelphia district.*

H. M. Ramsey has been appointed sales manager, tractor and implement tire div. of United States Rubber Co., with headquarters at Detroit.

Detrex Corp. has appointed Stanley A. Harris Eastern region Manager, with headquarters in New York City.

William C. Robinson has been elected a member of the Board of Directors of the Westinghouse Electric and Mfg. Co. R. L. Irvin has been made application manager, Small Motor Div. of Westinghouse. Four new vice-presidents have been elected by Westinghouse, as follows: R. A. Neal; J. K. B. Hare; John H. Ashbaugh and H. H. Rogge.

Nash Motors Div. of Nash-Kelvinator Corp., has named Ralph M. Kelly, formerly Buffalo zone manager, to head the newly established zone office in Cleveland.

Increased Demand for Heavy Artillery

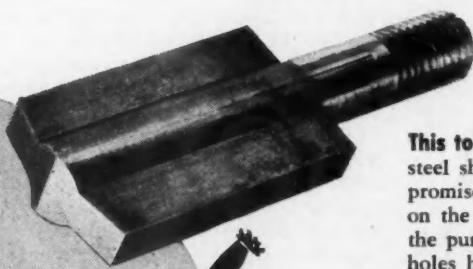
(Continued from page 46)

of the Wildcat which is powered with a "hitherto unannounced" Wright engine instead of the R-1830 1200-hp Pratt & Whitney engine. The new engine has forged instead of cast cylinder heads. The FM-2 can climb faster and is more maneuverable than the RM-1. It also has a slower landing speed and can take off from small escort carriers. GM produced 300 of the FM-2s in March. A new version of the Navy's Helldiver dive bomber is in production, it has been revealed, through announcement that Hudson Motor Car Co. is making outer wing sections for the SB2C-3. The new Helldiver has a more powerful Wright engine than the Wright Cyclone 1700-hp type which powered the SB2C-1 and has a four-bladed Curtiss electric propeller instead of the three-bladed variety.

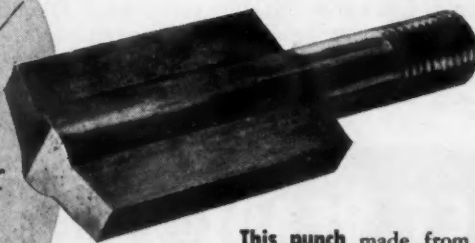
New Abrasive Warehouse

Abrasive Company's Los Angeles distributor, Almqvist Brothers & Viets, is expanding by augmenting the 15,000 sq ft housing metal-cutting tools, with a new abrasive warehouse. This building is stocked with a complete line of grinding wheels, mounted points, abrasive cloth, abrasive belts, coated abrasives and sharpening stones. The company is the exclusive distributor in Southern California for the Abrasive Company, Philadelphia, Division of Simonda Saw & Steel Company.

Which
OF THESE TWO TOOLS
Will Stay On The Job Longer
and Increase
Machine Output
Per Month?



This tool for punching 3/16" thick O. H. steel sheet was made from a tool steel that promised to provide the toughness needed on the job. But excessive wear meant that the punch had to be reground after 190,000 holes had been punched.



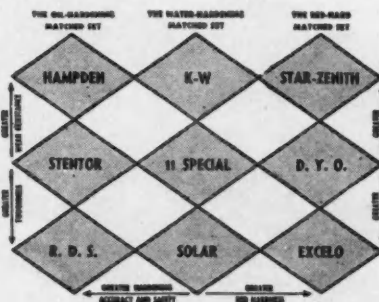
This punch made from *Stentor* tool steel provided just the right combination of toughness and wear resistance for the job. With it, production jumped over 100%—to 387,000 holes between grinds!

Here is WHY one tool
does a better job...

A tool giving 100% more production isn't just a stroke of luck! The tool room foreman knew what he needed for the job. He had found a *definite system* for picking the one tool steel that would do the job best. And as the heat treater had complete, easy-to-use instructions, they got real results from the very first.

You can do the same thing, by following the Matched Set Diagram. Carpenter can give you a definite system for finding the best tool steel for each job. And when you put Carpenter's heat treating information to work, you get real results. Full information on the Matched Set Diagram together with an 80-page tool index and steel selector is given in the Carpenter Matched Tool Steel Manual. Free to tool steel users in the U. S. A. Write for your copy today on your company letterhead.

The Carpenter Steel Co., 103 W. Bern St., Reading, Pa.



The Carpenter Matched Set Method. It points the way to the tool steel properties you need for almost any job. Result—better tools, more output from machines and presses, lower production costs.

For example, you start with the diamond in the center of the diagram, *No. 11 Special* straight carbon (water-hardening) tool steel. But when you want greater wear resistance, you travel north on the diagram. For greater toughness, you go south, etc. Each of the *Matched Tool Steels* on the diagram picks up its job where another leaves off, so you know in advance just what results to expect.

Carpenter
MATCHED
TOOL STEELS

Foremen's Strike In Detroit

(Continued from page 46)

other unions, but it is optional with the employer whether he recognizes the foremen's union or bargains with it.

The NLRB decision said in part, "We conclude that supervisors are 'employees' and that supervisory status does not by its own force remove an employee from the protection of the Labor Relations Act. . . . We do not mean to sug-

gest that every discharge of a supervisory employee for engaging in union activity is a violation of the Act. As well as being employees, supervisors are also representatives of management and their conduct is held attributable to their employer when it interferes with the rights of ordinary employees to self-organization and collective bargaining. That being true, we recognize the right of an employer to protect his neutrality by requiring his supervisory employees to refrain from unneutral activities which impinge upon the rights of their subordinates. . . . Consequently,

the right under the Act of supervisors to protection in their organizational and other concerted activities is not an unqualified one, but is subordinate to the organizational rights and freedom of rank and file employees, and to the need of an employer to maintain his neutrality."

Following the NLRB decision, the Ford Motor Co. announced that it had signed a contract with the FAA recognizing it as sole bargaining agent for 9,000 company foremen at Detroit area plants. Negotiations on the contract had been in progress since Feb. 1. It provides for union representation and grievance procedure, seniority, a schedule of wages and classifications and leaves of absence and sick leaves. However, other automotive companies, through the Automotive Council for War Production, expressed alarm at the NLRB decision. As spokesman for the council, which has 550 member companies, including Ford, President Alvan Macauley said, "The Council has given careful consideration to the adverse effect on war production of the strike of foremen in the 12 plants of major war producers in the Detroit area and the still greater threat inherent in the organized drive to unionize management, beginning with foremen. This is a long step toward putting industrial management in the hands of union leaders. . . . The issue now is: can union leaders unionize management and take over control of war production? Are their organizing drives for this purpose to be allowed to interfere with the efficiency and effectiveness of this production? . . . What kind of collective bargaining is it when union leaders sit on both sides of the table? This issue results directly from the fact that the federal laws and their administration are vague and confused in respect to the status of management. In the interest of the war effort, we urge Congress to make it clear that it does not intend to permit labor leaders to take over the management of our war production plants. This can and should be done immediately by clarifying and amending the necessary laws, particularly the War Labor Disputes Act."

A stalemate was reached when the National WLB said it would take jurisdiction over the dispute but only after termination of the strike. Keys pointed out that company managements had refused to meet with the FAA and that the foremen feared discrimination against them when they returned. But despite pleas by the Army and Navy that important war production was being hampered and assurances by the companies at the instigation of WLB that there would be no recriminations against returning foremen, the FAA would not yield. Finally, the AAF caused the closing down of the Packard plant, employing 30,000, due to its refusal to accept aircraft engines for lack of inspection supervision. This was followed by the shutdown of the

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Now



AN ANTI-FRICTION WORLD

Of countless brilliant improvements created by war production, none is more deeply worthwhile, none has more of basic usefulness, than the new applications of anti-friction bearings. We of Aetna know these, for we have helped to perfect them

—know their rich potential for creating a truly Anti-Friction World.

In getting ready for that new industry of peace, Aetna is helping many businesses—helping to develop new products and revitalize old

ones—helping with plans to recreate war-worn plants and equipment.

Is your business ready for the Anti-Friction World? Aetna engineers can help you, too. It's an idea that deserves action—simply call Aetna, or write.

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THRUST BALL BEARINGS,
Standard and Special
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... Special,
BALL RETAINERS
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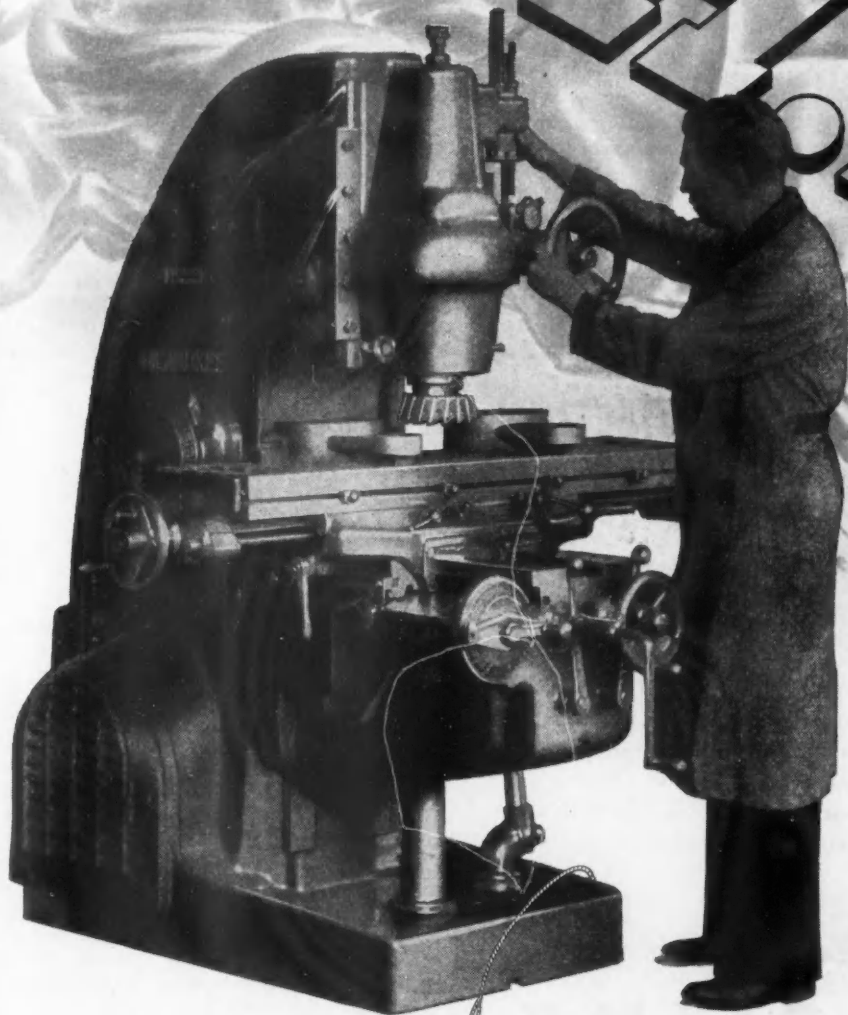
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TODAY'S HIGH PRODUCTION PRECISION MILLING BEGINS WITH MOTOR POWER



**MEANS EVERY
MILWAUKEE MACHINE
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TO DO THE JOB**

Milwaukee PowerRated Milling Machines
• Standard Models—Horizontal, Vertical
and Bed Types — available in Motor
ranges from 3 to 25 HP. • C.S.M. (Carbide
Steel Milling) machines 20 to 50 HP. •
Special Machines—Consult K&T engineers

In years past it was customary to purchase milling machines by range . . . depending on the size of work to be handled. The motor power was given insufficient consideration by most purchasers. For example, a model 2 machine with 3, 5 or 7½ hp. served practically all requirements in those days.

Today, however, with the constant changing of milling techniques, range is not the first consideration—hp. becomes the *number one factor* . . . the *starting point* when purchasing milling equipment. No machine which is engineered to handle work requiring from 3 to 7½ hp. can be expected to stand up very long if 15 to 20 hp. is substituted on the spindle.

You can always be sure that a Kearney & Trecker "Milwaukee" is correctly designed in terms of motor power, from the drawing board stage on through to the completed machine. Milwaukee Milling Machines are power-engineered — **POWERATED** — designed and built in keeping with their hp. range plus the normal overloads encountered within their field of job applications.

The next time you need milling equipment, think in terms of motor HP. for heavy cuts — range for light cuts. Consult a Kearney & Trecker field engineer. Explain to him the types of jobs which you intend milling. He will help you in deciding what PowerRated Milwaukee Milling Machine is best suited to your specific needs.

Back the Attack — BUY MORE BONDS

**KEARNEY & TRECKER
CORPORATION**

MILWAUKEE 14

WISCONSIN

Milwaukee Machine Tools



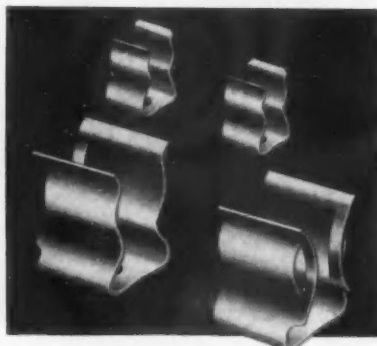
Briggs Mack Ave. plant for the same reason and the partial stoppage of final assembly operations at Hudson.

There followed the order of the WLB for the FAA to appear in Washington to show cause why it should not be subject to the sanctions and penalties of the War Labor Disputes Act. Davis pointed out to the FAA at the hearing that its strike shut off its only possibility of relief. But Gen. Arnold had the clinching argument when he excoriated the foremen and said, "We of the military services have no interest in the relative merits of this dispute. But it is inconceivable from our point of view

how this country can have strikes which stop war production at this particular moment. The plants which are on strike are producing war materials so essential that it may possibly determine the extent of our bombing of Germany, so essential that it may materially affect the invasion. The strike covers the Packard plant, which is producing Merlin engines for fighter planes. It is affecting the Briggs plant, where A-20, B-29, B-17 and B-24 parts are produced. It has hit Murray, making P-47 wings and B-17 parts; Hudson, making B-29 and P-38 parts. It already has cost us 250 P-51 airplanes."

COMPLETE CIRCUIT PROTECTION

requires FUSE CLIPS especially engineered to the multitude of today's services.



The Fuse Clip is not second in importance to the Fuse itself. The most scientifically constructed fuse can be thwarted in its functions by lack of dependability in its clips. Littelfuse specializes as thoroughly in *Fuse Clips* as in Fuses. They go hand in hand for complete circuit protection.

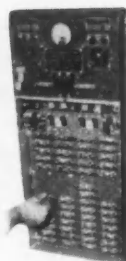
Littelfuse FUSE CLIPS

PHOSPHOR BRONZE • BERYLLIUM COPPER, SILVER PLATED

- Wherever fuse clips are used—in aircraft, communications, industry, electronics, electrical products—from most delicate meters to high voltage services, Littelfuse solves the problems with *new improvements*. By exclusive Littelfuse design and forming, the best possible contact is obtained, with maximum electrical conduction. Less heat is produced. Temperatures in panel boards and switches are reduced. Loss of clip-temper is prevented. Spring qualities are retained much longer. Contact between fuse-cap and clip is made over *largest possible area* with extra tight grip.

Whatever your fuse clip requirements, Littelfuse will be glad to counsel with you.

*Littelfuse equipment on Pan American Clipper.
Courtesy of Pan American Airways System.*



LITTELFUSE INCORPORATED

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CALENDAR

Conventions and Meetings

SAE Natl. War-Materiel Meeting, Detroit	June 5-7
Automotive Engine Rebuilders Assoc., Cincinnati	June 13-15
American Society for Testing Materials (47th Annual Meeting), New York City	June 26-30
SAE Natl. Transportation & Maintenance Meeting, Philadelphia	June 28-29
SAE Natl. West Coast Transportation & Maintenance Meeting, Portland, Oregon	August 24-25
SAE Natl. Tractor Meeting, Milwaukee	Sept. 13-15
SAE Natl. Aircraft Eng. & Production Mtg., Los Angeles	Oct. 5-7
SAE Natl. Fuels & Lubricants Mtg., Tulsa	Nov. 9-10
American Chemical Society Natl. Chemical Exp., Chicago	Nov. 15-19
SAE Natl. Air Cargo Mtg., Chicago	Dec. 4-6
SAE Annual Meeting, Detroit	Jan. 8-12

SWPA Issues Regulation

(Continued from page 48)

even after they have declared the property to be surplus.

The regulation provides that sale or other disposal of surpluses in active theaters of operation may be made by the military or naval commanders. Pending further regulations the Army, Navy and Maritime Commission are authorized to sell surplus property in those areas abroad where FEA has no local office, and in any of the territories and possessions of the United States where the appropriate selling agency has no representative.

Subsequent regulations will be issued to cover property not governed by Regulation No. 1, particularly real property other than those types of real property now assigned to RFC, Maritime Commission, NHA and FWA. Meanwhile agencies not covered by the regulation will continue to follow established procedures on unassigned property, keeping SWPA advised of plans, policies and procedures.

Vickers Establishes New Test and Service Center

Establishment of a West Coast Test and Service Center is announced by Vickers Incorporated, the added facilities supplementing the Sales Engineering Organization that has been established in the Los Angeles area for several years.

A fully equipped office and shop has been set up in Beverly Hills. Facilities, which include some of the most advanced designs of hydraulic testing equipment, make possible prompt inspection, test and repair work on the West Coast, obviating the necessity of returning all units to the Detroit Plant for this work.



hat's right . . . take a hair, magnify it 62.5 times . . . result — a husky rod. This is just what Jones & Lamson Optical Comparators do to those tiny dimensions that are difficult, or even impossible, to measure by any other means.

If you are a manufacturer of parts that must be right — to a hair — it will pay to investigate Jones & Lamson Comparators. These machines are designed for use in the shop (they don't have to be babied), and they can be used as easily as a mechanic's scale.

Jones & Lamson inspection engineers are at your service to study your particular measurement and inspection problems. Call on them today!

MEASUREMENT AND INSPECTION—BEYOND A SHADOW OF A DOUBT!



This book, "Beyond a Shadow of a Doubt" will be sent to executives asking for it on their firm letterhead.



JONES & LAMSON
MACHINE COMPANY

OPTICAL COMPARATORS Springfield, Vermont, U.S.A.

Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

Three Types of Lambert Disc Brake

LAMBERT Disc Brakes, a development of the Auto Specialties Mfg. Co., St. Joseph, Mich., are designed with three types of power application—mechanical, hydraulic and air—for use on passenger cars, buses, trucks, tractors and on power-take-offs. Depending upon the nature of the job, they can be built in single-disc or multiple-disc arrangements. Their general principle of

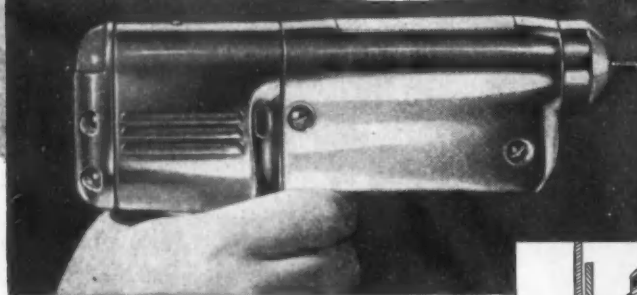
operation is illustrated in Fig. 1, which shows a sectional view of the single-disc, countershaft mechanical brake in production for tractors. The power plate is the fixed element, incorporating the return springs, the actuator lever or means of power application, as well as a series of power inserts and power rollers. Movement of the actuator lever, which fulcrums on two balls,

causes a corresponding movement of the actuator plunger, thus forcing the primary disc into contact with the middle ring and lining assembly. The middle ring assembly has freedom of end-wise movement on the shaft splines. As contact is established between the primary disc and the middle ring, braking action is effected by contact of the linings with the primary disc and the stationary element of the housing.

Braking action is amplified and controlled by self-energizing action. Referring to Fig. 1, it will be noted that the power insert consists of hardened discs fitted in the power plate and primary disc, suitably formed to hold the power roller. As the primary disc comes in contact with the middle ring, it tends to rotate slightly either clock-

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.



New Air Tool Drives "blind" Rivets Accurately... Automatically

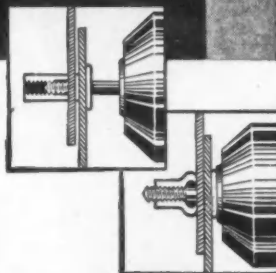
Installing "blind" RIVNUTS quickly with precise, positive upset while working entirely from one side is now possible with the recently developed Auto RIV-Driver. Completely automatic, the tool runs a threaded mandrel into a Rivnut, upsets it, backs the mandrel out and stops the tool. Operators simply press a throttle; make no manual adjustments for any operation. Rivnuts are installed 6 to 8 times faster than formerly; rejects are almost completely eliminated.

The tool can be adjusted to upset at any depth required. Once set, adjustment is tamper-proof—every Rivnut is driven accurately and uniformly. An indicator on the tool handle lights when the upset is correct; does not light if Rivnut is improperly headed.

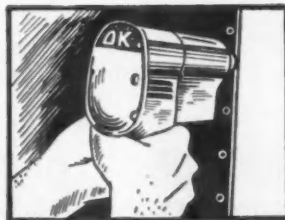
Powered by compressed air, the Auto RIV-Driver weighs just 4¼ pounds; is 9½ inches long; balanced for efficient handling by women operators.

You all know that our fighting men need the finest quality materials that we here at home can produce. That goes for Wrigley's Spearmint, Doublemint and "Juicy Fruit" chewing gum, too. Our stock pile of raw materials that goes into the making of Quality chewing gum is getting lower and lower. Until we can again build up our raw material inventory, we are sending all of our limited output of Quality chewing gum to our fighting men and women overseas, only.

You can get complete information from the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.



Rivnuts (mfd. by B. F. Goodrich Co.) are internally-threaded tubular rivets which can be installed "blind" while working entirely from one side of the job.



Automatic action, positive depth control and visual indicator assure correct and uniform installation of rivnuts with new Auto RIV-Driver

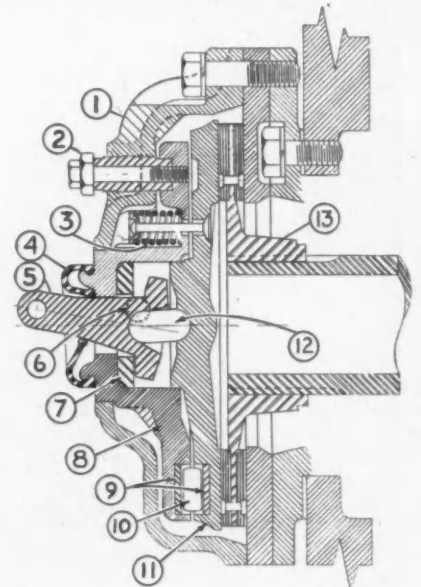


Figure 1

- No. 1—Brake housing.
- No. 2—Adjusting screw.
- No. 3—Return spring.
- No. 4—Enclosure boot.
- No. 5—Actuator lever.
- No. 6—Actuator balls.
- No. 7—Actuator lever washer.
- No. 8—Power plate.
- No. 9—Power inserts.
- No. 10—Power roller.
- No. 11—Primary disc.
- No. 12—Actuator plunger.
- No. 13—Middle ring and lining assembly.
- No. 14—Hydraulic seal.
- No. 15—Drive std.
- No. 16—Hydraulic cylinder housing.
- No. 17—Cylinder piston.
- No. 18—Secondary disc.

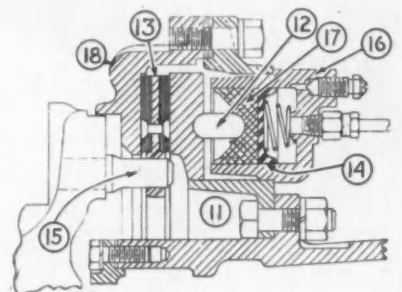
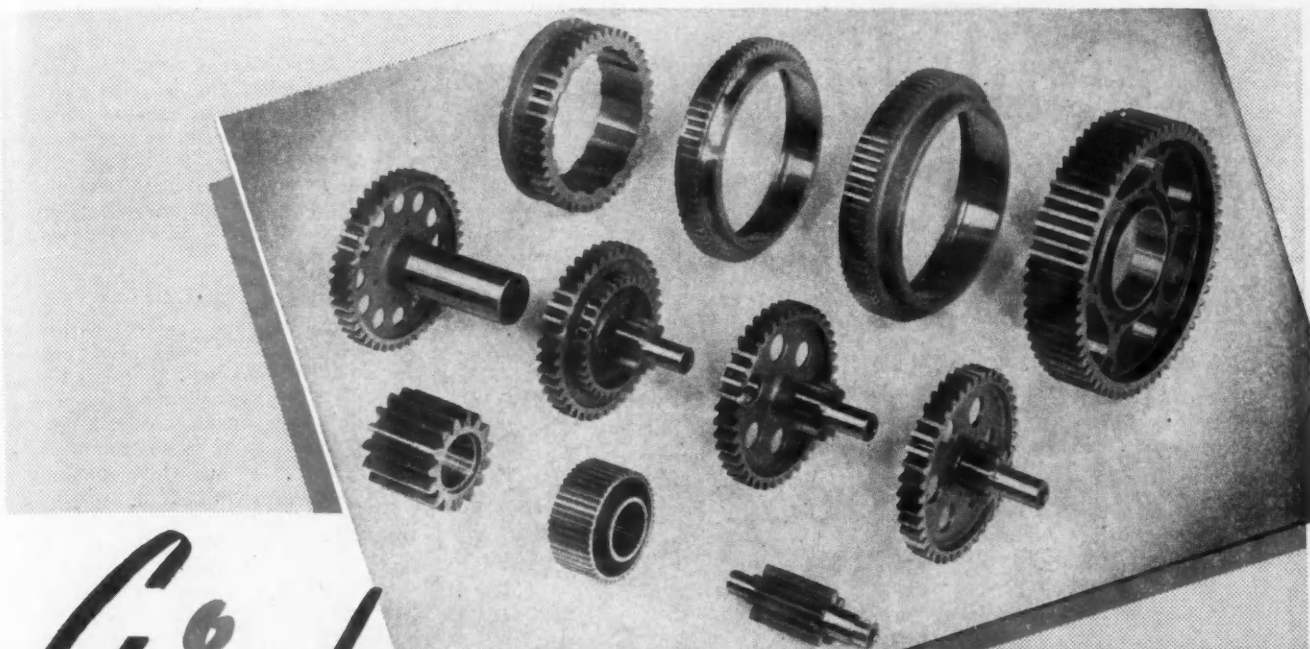


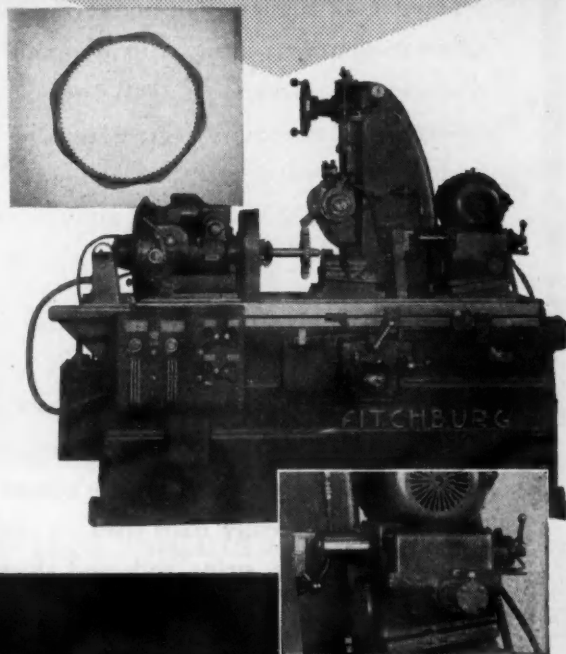
Figure 2



Grind AIRPLANE ENGINE GEARS LIKE THESE ON A FITCHBURG

The internal aircraft engine gears shown here were ground on the new Fitchburg Gear Grinder. As a result Fitchburg has been commended, right down to the operator of the machine, by a leading aircraft engine manufacturer—on the dimensional accuracy and finer finish obtained. These jobs were also performed in less grinding time than was possible before.

Similar results on a variety of work can be obtained on this machine—with the same quality and high production. Let Fitchburg engineers show you how. Prepare now to meet peace-time needs with greater production at low cost.



FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of — Bowgag Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

60% HIGHER
ELECTRICAL
RESISTIVITY
CHACE
Manganese
ALLOY
No 772

Recommended for use by manufacturers seeking an alloy with exceptionally high electrical resistivity . . . Chace Alloy No. 772 has an electrical resistivity of 1050 ohms per circular mil foot or 175 microhms per cm^3 —about 60% higher than most resistance alloys in common use . . . its temperature coefficient of resistance is .00014 per degree centigrade . . . resistivity value is not affected by annealing procedure, cold working or by cooling to -100°F . . . this alloy is non-magnetic.

Chace Manganese Alloy No. 772 also possesses . . . low thermal conductivity, 2% of value of copper . . . high temperature coefficient of expansion, twice that of ordinary steel . . . high vibration damping constant, about 25 times greater than steel . . . now available in sheets, strips, rods and shapes.

Complete engineering and research facilities available . . . "Bulletin No. A-942" giving detailed information regarding Chace Manganese Alloy No. 772 sent on request.

W.M. CHACE CO.
Manufacturers of
Thermostatic Bimetals and Special Alloys
1610 BEARD AVE • DETROIT 9, MICH.

wise or counterclockwise depending upon the movement of the vehicle or shaft. This displacement in either direction changes the relative positions of the power inserts, causing the roller to move up on the inclined surfaces of the power inserts. This action, in turn, increases the displacement between the power plate and primary disc with a consequent increase in pressure on the middle ring.

Fig. 2 shows the upper hydraulic mechanism of a production axle brake employing hydraulic actuation through two pistons which are interconnected for equalization. Here the piston takes the place of the mechanically-operated actuator lever shown in Fig. 1. In this arrangement, there is a secondary disc bolted to the power plate, forming a self-contained housing in which the surface of the secondary disc offers the braking surface for the outer lining. This is a special case of hydraulic application. The general type is known as the Collarfram hydraulic, featuring a single, large diaphragm applying pressure uniformly through a multiplicity of contact points on the primary disc.

For air brake actuation a continuous diaphragm, as in the case of the Collarfram hydraulic brake, is connected to the reservoir tank and valve. Pressure of the diaphragm is transmitted through a pressure plate connected to the primary disc. This type of brake is intended for large buses or trucks and features a multiple-disc middle ring assembly.

Initial adjustment of Lambert brakes, as well as adjustment for wear in service, is provided in a variety of simple ways depending upon the application. For example, in Fig. 1 the adjustment is made by means of three adjusting screws. For adjusting, the screws are turned until contact is made with the primary disc, then retracted just enough for clearance. The larger unit (Fig. 2) uses a stack of thin shims between the power plate and the secondary disc. Thus the space can be increased or decreased as required by adding or removing shims.

Makers of Flightex Change Company Name

Atlantic Rayon Corp., successors to Suncook Mills, manufacturers of Flightex fabric and tapes for the aircraft industry, will be known hereafter as Textron, Incorporated, and the Industrial Fabrics Division will be called Flightex Fabrics Division.

The Flightex Fabrics Division produces Flightex fabrics and tapes of Arizona pima cotton and nylon for passenger and cargo parachutes. Post-war plans of the Flightex Fabrics Division call for the production of a complete line of fabrics for industry, including special coated interior fabrics for the aircraft and automotive fields, upholstery fabrics and slip cover materials.

EXAMPLE OF *Service*:



"How to reduce tool wear in drilling operations?" . . . A manufacturer put this problem to a Cities Service Lubrication Engineer. Our engineer surveyed operations . . . recommended a special *transparent* blend of Cities Service Cutting Oil . . . increased tool life by 25%.

For another "Example of Service" write for *your* free copy of METAL CUTTING FLUIDS—26 pages of helpful information. Address: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

More and more, it's service that counts . . .
and *Cities Service* means good service!



CITIES SERVICE OIL COMPANY

ARKANSAS FUEL OIL COMPANY

Future Highway and Truck Design

(Continued from page 29)

greater spring centers. The available space for brakes would also be increased and, even though this space still would be inside the wheel, important improvements could be made by changing proportions which should increase the space between the drum and the rim, thus making possible better air flow around the brake.

Vehicle Weights

The relationship between length and

weight as set forth in the Interregional Report is also interesting. The report sets limits on gross weight by means of a formula that makes weight a function of length. The formula is: $W = C(L + 40)$, in which W is gross weight of vehicle in pounds; L is length in feet between the forward and rear axles of the vehicle or combination of vehicles, or any group of axles thereof; and C is coefficient of 650 when L is less than

18 ft., and 750 when L is equal to or greater than 18 ft.

For a single vehicle limited to 35 ft length, and on the basis of normal design practice, a six-wheeler could be set up which would have a rating of 46,000 lb. It would be possible to increase this to a maximum of 54,000 lb by moving the rear axles as close to the rear end as possible and the front axles as close to front as possible, thus making the controlling distance between the front and rear axles a maximum. However, this design would involve a front axle load of 18,000 lb, and although promising designs have been proposed for dual tires on front axles, and power steering gears have been developed which would take care of an axle load of this amount, there still remain many problems to be solved to make such an arrangement practicable.

The tractor semi-trailer, which is limited to 50 ft length (Fig. 3) could be rated at 62,000 lb. With the limitation of 18,000 lb per axle, this would require four axles. For other combinations, a maximum of 70,000 lb is indicated, and this would probably require five axles, although, as with the single unit and subject to the same problems, a four-axle design can be visualized (See Fig. 4).

Engine Power and Vehicle Performance

Some light on the engines that will power these trucks is shed by the report's proposals concerning speeds. The design of the new highways will permit 60 mph for trucks and tractor combinations in flat topography and 35 mph in mountainous country. Assuming as reasonable a total resistance of 30 lbs per 1000 lbs weight for a heavy vehicle, we find the following requirements at 60 mph: single unit, 245 hp; tractor semi-trailer, 330 hp; combinations, 373 hp. Using these values and figuring back, we also find that the speed which can be maintained on the grades provided for in the report are for all categories 35 mph on a three per cent grade and 21 mph on a six per cent grade. It is apparent, of course, that these represent a considerable increase in power over current practice and it is possible that it will be found impracticable, because of higher initial cost, either to provide or to justify the provision of such high power.

Operating Costs

On the other hand, the effect on operating costs of high horsepower is too frequently supposed to be all bad. Undoubtedly, this opinion is responsible to a large degree for the use of under-powered vehicles. Several years ago an attempt was made to obtain some information on this subject. The results provide some interesting data on the relationship between advanced highway design such as is envisaged in the Interregional Plan, high-powered engines, and operating costs. A tractor semi-trailer of 40,000 pounds CVW was driven between Ardmore and Pitts-



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William H. Miller, Vice-President



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One of these engineers is a Bryant man. We urge you to call him today. For his specialized knowledge of internal grinding machinery is important to the manufacture of literally everything that will make this country a finer place: this is victory, a victory that it will be safe for our boys to come home to.



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burgh over the Lincoln Highway and the Pennsylvania Turnpike. Six round trips were made and the average of the odometer readings for the six trips was 570.7 miles. The distance on the Turnpike was 319.12 miles and on the rest of the road 251.5 miles, or 55.9 per cent and 44.1 per cent, respectively.

On the first trip, an engine of 377 cu in. displacement and a two-speed rear axle having gear ratios of 6.53 and 8.53 were used. On the succeeding runs, larger engines and different rear axles with different gear ratios were used. For purposes of this discussion, the comparison of trip No. 1 with

equipment as noted above and trip No. 6 with engine of 501 cu in. displacement and a single speed, double reduction axle with a 6.77 ratio will be made. Operational data for these two trips are given in Table II.

Trip No. 6 saved 2.78 hours. The running time on the Turnpike was 9.00 hours on trip No. 1 and 7.50 hours on trip No. 6. Thus, 54 per cent of the time saved was on the Turnpike, which represented 55.9 per cent of the distance. The actual time on the Turnpike was 49.5 per cent on trip No. 1 and 48.8 per cent on trip No. 6, which in view of the variables involved is a

negligible difference. If the average speed attained on the Turnpike could have been maintained over the rest of the distance, the running time on trip No. 1 would have been 16.1 hours, and on trip No. 6—13.4 hours. On the other hand, if the whole distance had been the same kind of a road as the portion outside the Turnpike, trip No. 1 would have required 20.8 hours, and trip No. 6—17.85 hours. Therefore, the high type road would show a saving of 4.7 and 4.45 hours with the two different pieces of equipment, while the more powerful equipment would save 2.95 hours on the conventional road, and 2.7 hours on the high type road.

The gasoline used on trip No. 1 was 115.15 gallons, and on trip No. 6—115.7 gallons. Of these quantities, 61.7 gallons on trip No. 1 and 63.9 gallons on trip No. 6 were used on the Turnpike. If the rate of consumption for the Turnpike had been maintained for the whole trip, 110.5 gallons would have been used on trip No. 1 and 113.2 on trip No. 6. If the rate needed for the ordinary road had been required for the whole trip, then 121.5 gallons would have been used on trip No. 1 and 117.8 gallons on trip No. 6. These figures seem to show that the high type road has less effect in producing economies in fuel consumption with a powerful vehicle than with one less powerful. However, the saving in time produced by both the high type of road and by the high-powered vehicle is significant.

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Spectrographic Analysis

(Continued from page 33)

perimental work has been done on concentrations of elements up to 25 per cent. Accuracy of the new technique is said to compare with conventional chemical analysis.

A period of experimentation evolved a method of applying standard correction factors to densitometer readings when these critical elements are involved. In practice, densitometer readings are taken of the spectrum in the usual manner, then suitable corrections are applied from specially prepared tables and charts. The secret of analyzing major percentages of elements was found to lie in the adoption of a powerful arc, excited by high values of voltage and frequency. To this end, the research staff developed a unique but simple arc exciting mechanism employing voltages upwards of 35,000.

Early in this work it was found that densitometer readings were affected by variations in the sensitivity of photographic plates, this quality varying from one plate to another. Today, each plate is calibrated so as to provide the proper correction factor to the basic densitometer readings. This is done by running a standard iron spectrum on each plate and cross-checking with a standard bronze sample.

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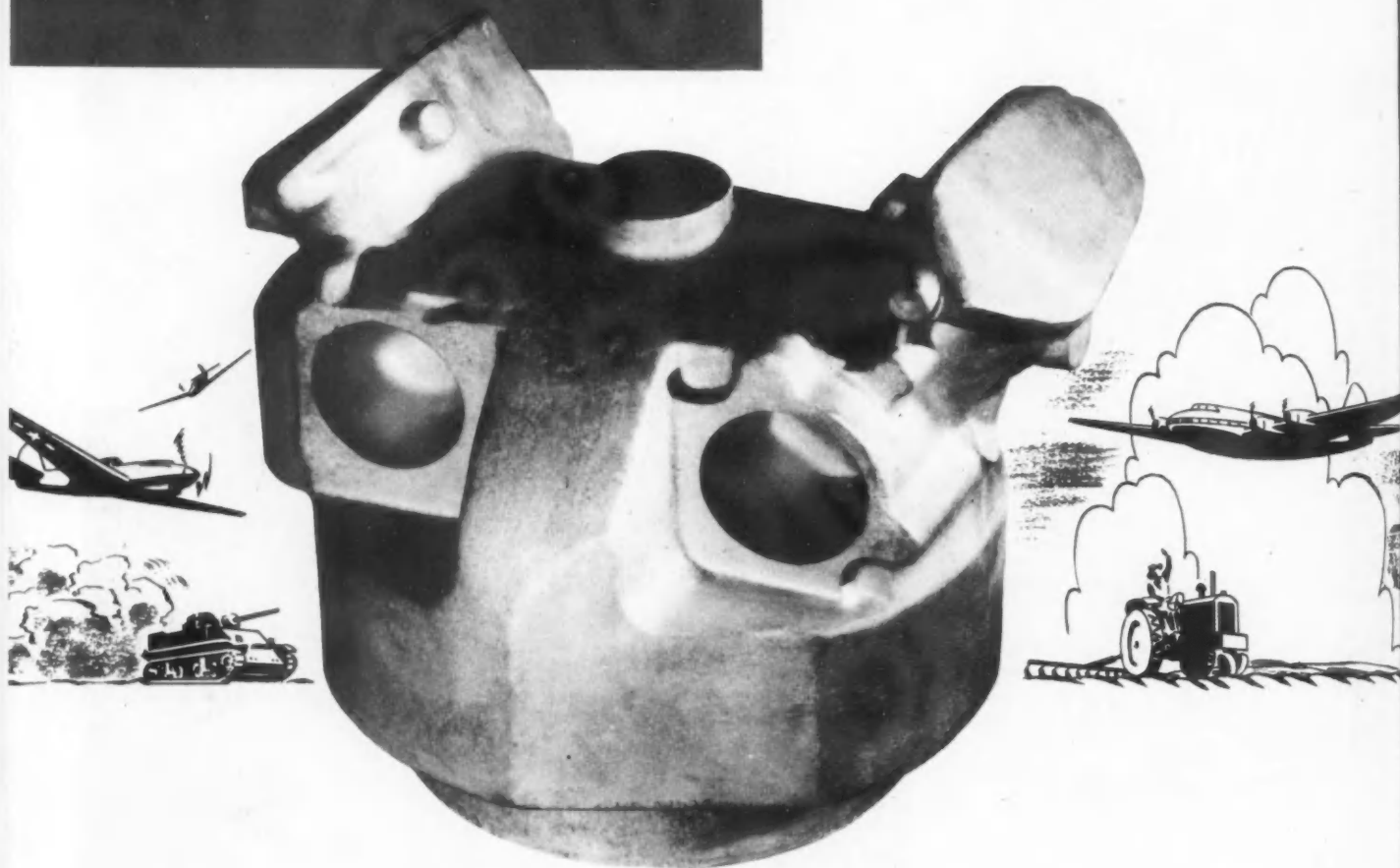
Torpedo Squadron 8

BY JAMES M. SESSIONS

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Commemorating the epic sacrifice made by Torpedo Squadron 8 in the Battle of Midway (see reverse side) is Sessions' 6th in a series of 12 dramatic war paintings presented by Tube Turns.



Vibration in Aircraft Power Plants

(Continued from page 24)

is less than 7/10 of the forcing frequency. To remedy the excessive vibration of the crankshaft, a pendulum type damper was installed. This damper was tuned to 7½ order so that the vibration forces previously absorbed by the crankshaft would be absorbed by the damper. These assumptions and the preventative solutions were proved correct by subsequent flight tests and future operation of the airplane was unhindered by objectionable vibration.

Another problem which came to our attention was a vibration condition on a large modern-multi-engined airplane. This plane was equipped with the very latest equipment, among which were vibration absorbers and mounts which appeared to be entirely satisfactory. However, pilots reported that objectionable vibration was so severe that equipment such as generators and starters were cracking at their mounting and the supporting bolts were rupturing and the equipment was falling off. To determine the cause of this trouble, tests were run in the same manner as that described for the training plane above. An analysis of the results showed that a large thrustwise force occurred within the operating range. This force could not be explained since all of the mounts and vibration absorbers seemed to be functioning satisfactorily, but to be absolutely sure that the bushings were not at fault, a complete new set was substituted and the plane was flown again. The results of the second test showed the same condition, the thrustwise force being definitely present.

Assuming now, that the engine was not the cause, tests were performed on the propeller, using carbon strain gages. The results of this test showed that the propeller was stressed, but not to a sufficient degree to produce resonance. Since none of the tests thus far showed any predominant faults, a thorough examination was made of the engine blueprints. But here again the analysis was not conclusive, so a final test was run on the propeller hub and the nose of the engine frame. This test proved justifiable for itself as well as for all previous tests because it clearly showed that the key to the whole trouble was not in the engine mounts, but was the result of excessive play in the thrust bearings of the engine. The solution to this problem was obvious once the sources of the trouble had been discovered, for upon the adoption of our recommendation for reduced bearing tolerance, the trouble disappeared.

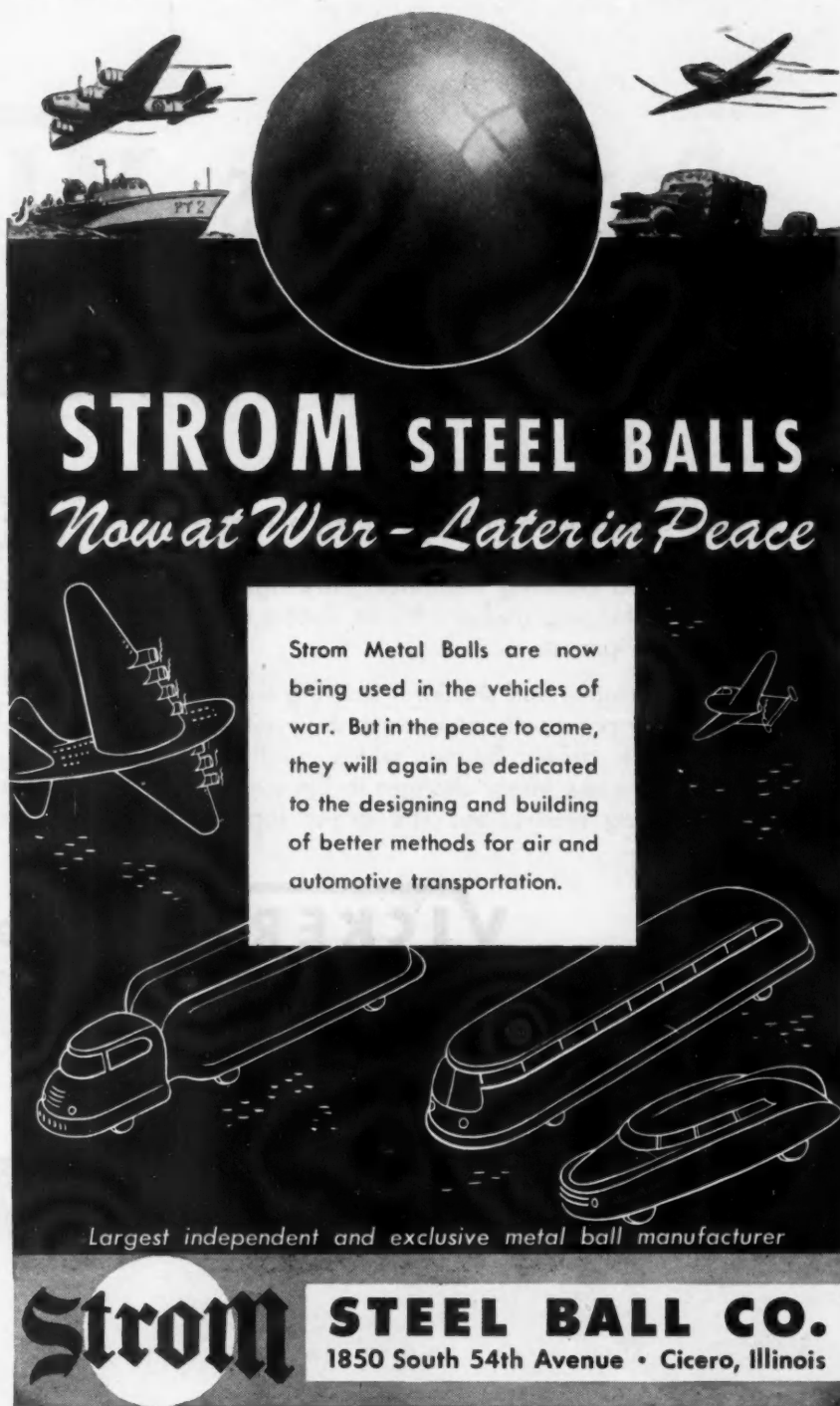
A final example of the different vibration adaptations will be found by examining the results of a test on a single-engined airplane with a V-12 in-line engine rotating a gear-driven

propeller. In an airplane powered by a gear-driven propeller, any undue vibration of either the propeller or the engine is immediately noticed by the pilot since the motion is transmitted to the airplane structure through the reduction gears and their supporting members. The opposite of this is true in an airplane with a direct-driven propeller, since the coupling between the engine frame and the rotating crankshaft is negligible. For this reason vibration may exist to such a serious

degree that internal damage may occur within the engine or propeller and yet the condition may go unnoticed by the pilot.

Since this example deals with a geared propeller, the objectionable vibrations were noticed by the manufacturer and as a preventative measure he installed Lanchester type friction dampers on the crankshaft at the front crank throw. When a series of torsional tests were run on this engine, the results proved that there was a node (zero amplitude and maximum stress) at this point, which, of course, would render the damper ineffective.

(Turn to page 70, please)



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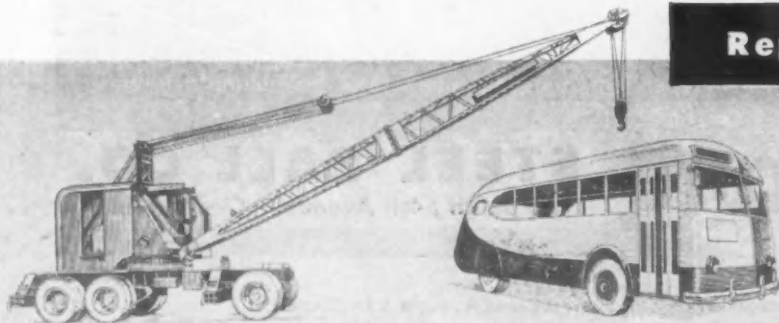
only enough energy through the steering wheel to control the hydraulic valve . . . a finger is sufficient. The hydraulic cylinder (booster) supplies the power to turn the front wheels so that they exactly follow the steering wheel movement, utilizing pressure from the engine-driven pump. Road shock thrusts are transmitted to the frame instead of to the steering gear.

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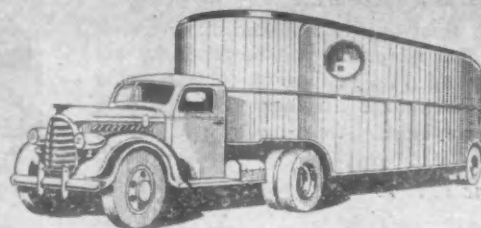
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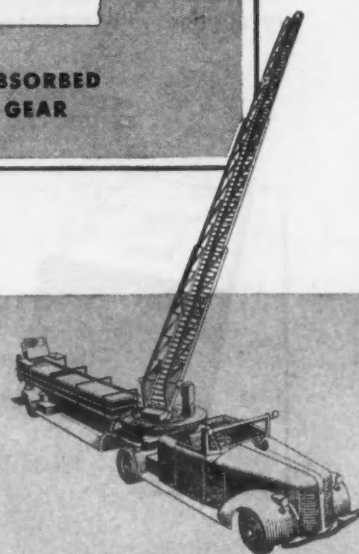
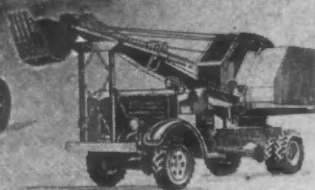
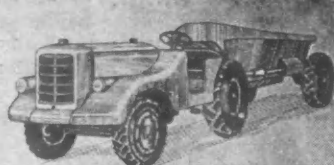
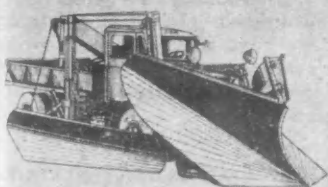
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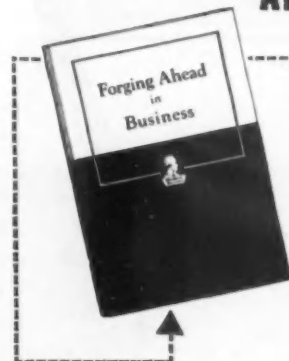
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To remedy this condition the dampers were relocated to a point at the rear of the crankshaft where the amplitude approached its maximum. Here the dampers were permitted to function at a maximum efficiency and the objectional vibration was soon minimized.

It may be seen from the solution of the foregoing problems that a marked similarity exists in the solution of all vibration problems. This may be summed up stating that the first step is discovering the problem either by tests for this purpose or by evidence of its damaging effect; the next step is to perform tests for the classification and measurement of the vibration, and the final step is to devise corrective measures from examination of the results of these tests. These corrective measures may endeavor to absorb the vibration as in the case of the pendulum damper, or their purpose may be to reduce the transmissibility to a minimum as in the case of the rubber bushings in the first example. But whatever conclusion may be drawn from these comparative measures, the persistent problem of vibration will continue to arise to harass designers of new equipment.

Free Men on a Tended Herd

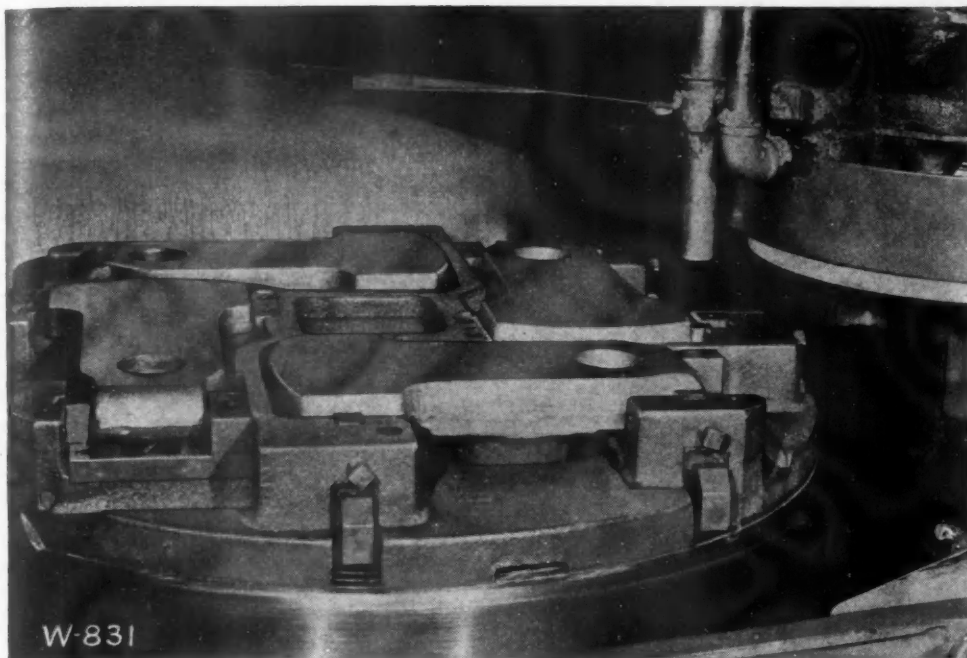
(Continued from page 15)

Have we listened to the wrong teachers, to pedagogues of a wrong theology? Have we not been inspired by wrong thinking and got our quanta of energy confused with the molecules? Have we forgotten the only being worth remembering—the individual human being?

In writing the Declaration of Independence and the Constitution, the fathers of our country were moved by the unalterable purpose to free themselves and their posterity from the oppression of the Old World and elevate the individual to sovereign dignity. They builded with imperishable stone.

The elemental situation has not changed from their day to ours. Instead of a country of a few million people, we have a country of one hundred and thirty million people. That means more and not less opportunity. The world around us is much greater than theirs because, where their frontiers were limited by the map, our frontiers are unmapped, for they are far off somewhere in the great new world of physical discovery. Nothing has happened to make necessary a change in our concept of individualism.

The American system can fail only if we, as individuals, fail. In man alone can we find hope for a future. Whatever may be the seeming dangers of throwing off our controls and once more being Americans, they are as nothing in contrast to the dangers of being merely a tended herd. It all depends on whether we have what it takes—From Dr. Dow's address on receiving the Gold Medal Award of the American Institute of Chemists.



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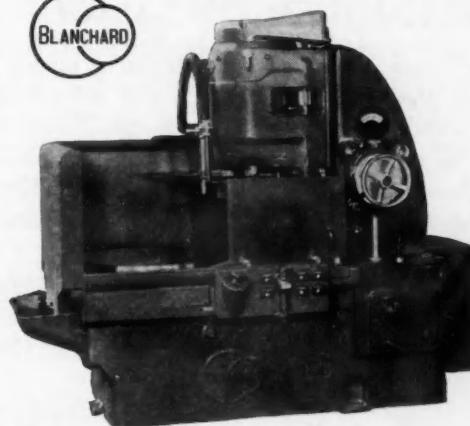
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71

Automatic Clearance Regulators

(Continued from page 33)

Camshafts do not run perfectly concentric, and if one does so now and then, all continue to deflect under load. If an automatic adjustment sets the linkage clearance to zero while the base of the cam contour is not running true, something very bad is bound to happen. To compensate for this a constant clearance must be incorporated in the linkage, which also will provide temporary compensation when the linkage expands or contracts while the engine is standing still. This constant clearance would

normally constitute a lost motion. However, a device was developed by means of which the lost motion could be utilized on the opening side to lock the threads and, after the closing of the valves, to unlock them. A simple torque spring sufficed to adjust any excess clearance to zero, leaving only the constant clearance which is built into the mechanism.

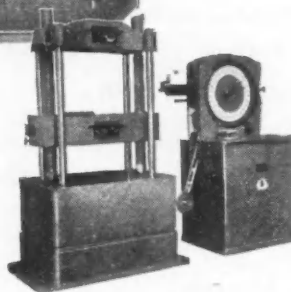
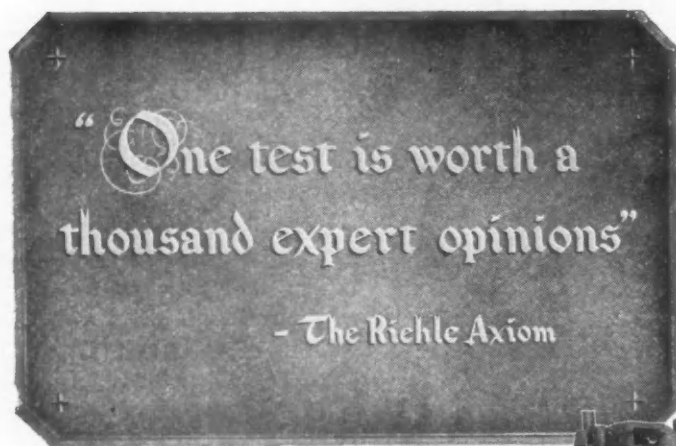
The mechanism developed by combining these several essential units is the clearance regulator shown in Fig. 5. In

it the ordinary adjusting screw has been replaced by a pair of telescoping members, *A* and *B*. These two parts enclose between them a compression spring *S*, which continuously urges members *A* and *B* to lengthen in the direction of their axis, but pin *D* stops this movement when the constant clearance *C* is established. The lower end of a torsion spring *T* is anchored to pin *D* while the upper end of it is anchored to the spring-wire form *E*. These parts constitute the automatic clearance regulator. To understand its function, we should note that pin *D* is mounted into the threaded sleeve *B* through a press-fit and is otherwise suitably held in position. This pin also passes into member *A*, and as it slides within member *B* by the amount *C*, it is obvious that its cylindrical portion must be provided with diametrically opposite slots that are made helical so that the telescoping motion of member *A* also induces an oscillation.

The telescoping motion is provided to allow room for the run out of the cam shaft and for changes in linkage length while the engine is standing still without in any way affecting the firm seating of closed valves. The engine will therefore hold its compression. The oscillating motion tends to lock the threaded engagement between the member *B* and the rocker arm during the incipient motion of the pushrod before the valve is lifted. This incipient motion is of course limited by the constant clearance *C*. When the clearance is taken up, the threaded engagement is locked and co-acting shoulders of members *A* and *B* come in contact for lifting of the valve through locked threads, essentially as valves are now lifted by conventional mechanisms. After closing of the valve, the oscillating motion of member *A* unlocks the threaded engagement and in so doing it provides some excess clearance. While the tappet travels over the base circle, the torque spring *T* has ample time to exert itself to take out any excess clearance that is left after due allowance for expansion. Taking up of excess clearance will in no way affect the constant clearance *C*.

In substance the function of the clearance regulator is described above. A mathematical study of the locking and unlocking of the threads is presented in greater detail in the appendix.

It has been pointed out that the adjustment means are locked while the valve is in motion. In addition, a safety feature has been added that locks the automatic mechanism in case a valve should stick or a valve spring break. In the top end of the adjusting sleeve *B* is a snap ring which also forms the abutment for spring *S*. The snap has two prongs *F*, which are conveniently positioned to straddle the fixed wire form *E*, allowing the desired amount of additive and subtractive adjustment. When the prongs abut against the wire form, the automatic adjustment is locked and the mechanism functions like a conventional manually adjusted



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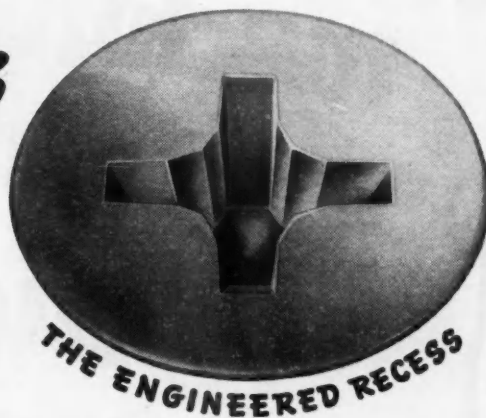
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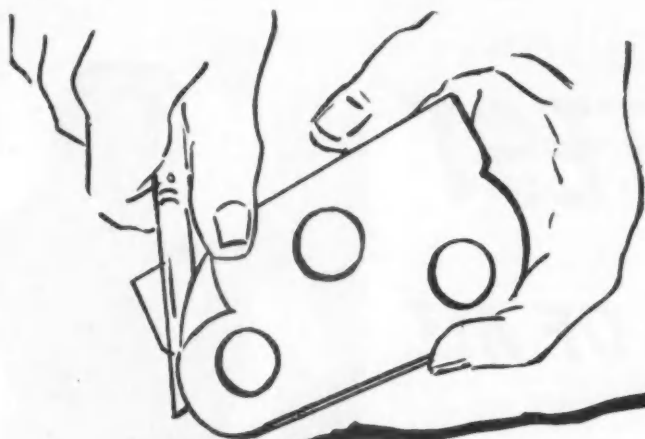
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mechanism. At the same time the position of the prongs relative to the wire form reveal at any time the position in which the automatic adjustment is. This tell-tale can be relied upon for inspection of valve clearance and for a check of the available amount of additive and subtractive linkage length variation. It is set automatically when the engine is running and does not change while the engine is cooling off. An additional advantage is that the setting of the self-regulating adjustment is visual while the conventional manual adjustment depends on less reliable feel and above all on the temperature balance of the engine.

It is characteristic for air-cooled engines that while they cool off, the clearance normally provided for the valve linkage disappears. Obviously the minimum clearance must be equal to or greater than the amount absorbed during the most extreme cooling off that may be expected. Bearing this in mind, it is obvious that with the clearance regulator described here, less difficulties for starting will be encountered because the regulator automatically insures that the normal clearance exists before the engine is shut down for any reason that may result in an unusual cooling off. We cannot always be sure of that with conventional manual adjustments. The clearance regulators thus provide one safeguard to insure prompt starting, but furthermore, while the engine is being turned over by the starter, the clearance regulator provides more clearance. Upon starting, the cylinder expands, which quickly provides clearance, and after a two minutes running, the engine will operate with standard clearance.

Conclusions

In this article we have called attention to some serious weaknesses existing in valve linkages. Test data supporting these weaknesses have been merely mentioned. We wish here, however, to refer to the classic tests by E. H. Olmstead and E. S. Taylor published in the July 1939 copy of the *Journal for the Aeronautic Sciences* and to the experiences later revealed by Carl T. Dowan in the September 1943 *Journal of the Society of Automotive Engineers*. Judging by the results and interpretation of a large number of tests, the writer is convinced that the clearance regulator and the aperiodic acceleration here recommended will help to solve the problems pointed out by them. Fig. 6 shows a regulator now undergoing rigorous tests.

APPENDIX

Adjusting Forces in Valve Clearance Regulator

In the diagram of forces Fig. 7, the square member corresponds to the constant clearance element A of Fig. 5. The cylindrical part represents the pin which is fastened into the adjusting screw B. The valve linkage, when it



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starts from rest, exerts the force P which, as long as clearance exists in the regulator, is equal to the pressure of spring S . For example, $P = 10$ lb. Beginning with this moment, the force P also presses the adjusting screw B against that side of the threads which has to transmit the valve lift pressure.

Because of the helical slot, free axial and rotary motions as well as a slight impact are introduced. The rotary motion of part A is resisted only by friction and, therefore, the horizontal component H determines the pressure R upon the pin, which my design is integral with the adjusting screw B . The

vertical force V adds to the pressure of spring S while the torque spring T with a moment of approximately .05 in.-lb adds to the turning effort of the tangential force H which acts at a radius of 0.25 in.

For an adjusting screw having eight threads per inch and for a constant clearance element having a helical slot as shown in Fig. 7, the forces created by the closing of the constant clearance C are in equilibrium if:

$$2\pi [.25H + .05] = \frac{P + V}{8}$$

The left side of this equation repre-

sents the torque which, exerted on the adjusting screw, tends to lock the threads; the right side represents the static forces opposing motion of the threads. These are naturally augmented by friction, which can be accounted for by multiplying the left side of the equation by the efficiency of the screw threads " η ." Hence, equilibrium within the threads exists if:

$$\eta 2\pi [.25H + .05] \leq \frac{P + V}{8}$$

After substituting numerical values taken from Fig. 7, we find that equilibrium exists if:

$$\eta \leq .709$$

Of course the form and lead of the threads are chosen so that they are self-locking, in which case the efficiency is known to be less than .500. Hence, according to the above analysis, the incipient linkage motion will tend to lock the threads, but cannot actually cause any change in the existing adjustment. As a result, for the entire valve lift period, a valve linkage as firmly locked as a conventional manually adjusted linkage is assured.

A minimum of valve velocity is provided at the moment of valve closing. After the valve is firmly seated, the linkage is permitted to move again to re-establish the constant clearance. Due to the force of spring S , the center of the pin now moves from O_1 to O_2 whereupon the pin touches the upper side of the helical slot and a pressure R_1 results. This pressure gives rise to components H_1 and V_1 acting upon the pin and therefore on the adjusting screw B . Inasmuch as in traveling from O_1 to O_2 the linkage has gained some velocity and as the designer can control this, some impact will occur even with cold starting when the speed is very low.

In either case, however, the horizontal component H_1 will suffice to turn the adjusting screw upward enough to insure the full constant clearance even though the linkage may have expanded somewhat. For the case of cold starting, we have $H_1 = 1$ and $V_1 = 1.428$ and our equilibrium equation reads:

$$\eta 2\pi .25H_1 + \frac{P - V_1}{8} = 2\pi .05 = .314$$

Again substituting numerical values taken from Fig. 7, we obtain:

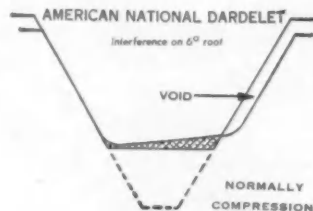
$$\eta = .119$$

Even at low temperatures, the degree of efficiency attained will insure automatic adjustment. At running speed we may have $H_1 = 2$ and $V_1 = 2.856$ and our equilibrium equations gives:

$$\eta = .078$$

It is evident, therefore, that even under very adverse conditions the spiral groove will insure adjustment and hence constant clearance and, as a consequence, firmly closed valves and constant timing.

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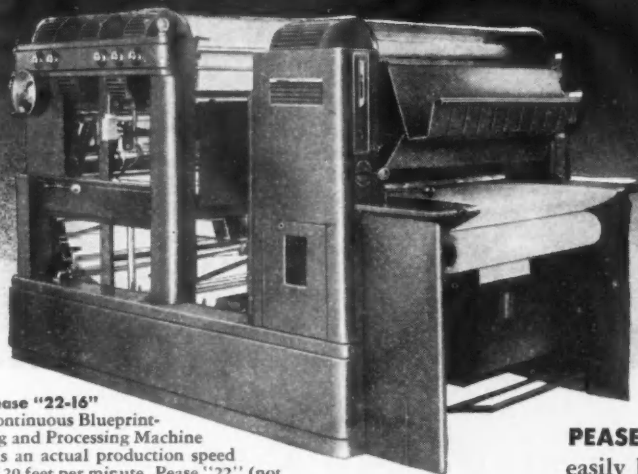
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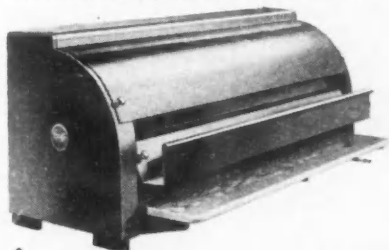
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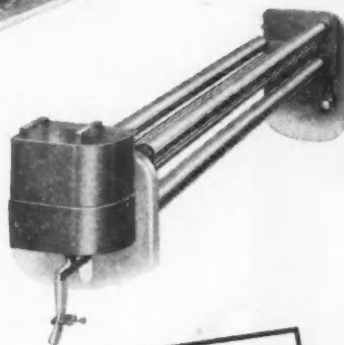
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Sensible Planning

(Continued from page 17)

in large volume. Jobs are made in the long run by these private expenditures, and whether we have reasonably full employment after the war depends on the ability and willingness of people—as business men and as consumers—to buy. Government can do much to affect both of these requirements through wise tax policy and through encouragement of business enterprise, and management and labor can help

by low-production costs and a low-price policy, but it is the people who, in the end, must provide the means for their own employment.

There will be no question as to the ability of the public to buy. At the end of this year of 1944 the people of the United States will have, as savings of only three prior years, more than 70 billions of dollars of free funds.

Business and industry, in spite of

high taxes, will have surplus funds, providing those locked up in inventories and accounts receivable are promptly freed for use. The Department of Commerce has attempted to estimate the immediate postwar requirements of business and to compare total needs with the resources available. Tax accruals, reconversion costs, funds to finance peacetime inventories and other working-capital requirements are estimated at 36 billions. The Department figures that industry and business will have resources to meet these requirements in these forms: 35 billions in cash and Government bonds; settlement of contract claims on contract termination, 9 to 14 billions; and depreciation and other reserves, 5 billions.

Public-opinion polls have shown that only a small part of the people understand the need industry has for quick settlement of contract-termination claims, as soon as general cancellation begins. The simple fact that 9 to 14 billions of industry's working capital will be tied up in cancelled contracts at the end of the war, and that this is 25 to 40 per cent of the total working-capital requirements to get back into peace production is something we need to advertise.

The total investment of the Government in war plants is 15½ billions. This is equal to the depreciated value of all prewar, privately-owned plants in the country, and this fact has led to alarm as to the consequences if Government should be led by choice or circumstances to undertake Government operation of these plants after the war.

An examination of the nature of these Government-owned plants allays some of this concern. I am of the opinion that the final effect of war construction on the country's peacetime manufacturing facilities will be much smaller than many believe.

To begin with, 30 per cent of the total investment is for strictly military products, such as guns, ammunition, explosives, and shell-loading, which cannot readily be used for peacetime products. Forty-one per cent of the investment is in three greatly over-expanded industries: aircraft, ships, and non-ferrous metals. Seventeen per cent of the total is represented by iron and steel, chemicals, and petroleum and coal. These specialized plants can be used only in these industries. This leaves only 12 per cent or about 1.8 billions in the general manufacturing field.

In this connection it is pertinent to point out that reduction in multiple-shift operation—from, say 225 per cent of first-shift employment to 150 per cent of first-shift employment, and reduction of hours per shift from 48 to 40, would require all of the facilities now in use, and 83 per cent of those employed for 55 per cent of present production according to the simple arithmetical ratios involved.

Looking back over the experience of the past few years, there has been much



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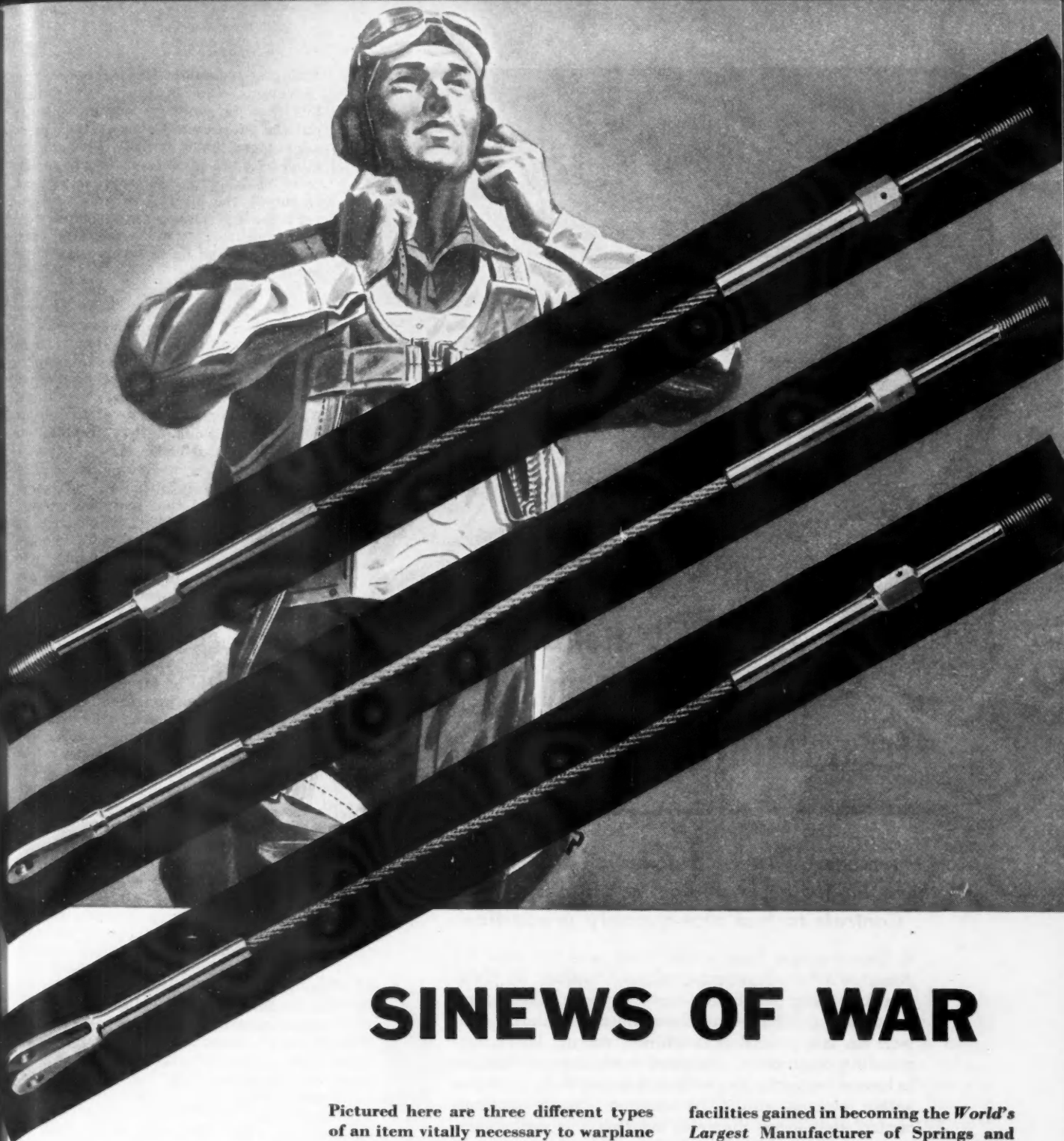
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less cost-reduction from large-volume operations and large-manufacturing lots than is generally assumed; or to put the question more accurately, these advantages have been wiped out by other cost disadvantages, such as the costs of preliminary training of new employees, the dilution of skill and supervision by the too rapid increase in employment, by higher salary and wage-rates, and by heavy overtime and night-turn bonus.

One significant fact is the increase in factory expenses per hour of productive labor that can be observed generally, instead of the reduction in these expense rates that one would expect with increase in volume of productive labor under more normal conditions. All of this adds up to one of the major postwar problems—the problem of high-manufacturing costs.

The public is beginning to realize that the same automobiles, refrigerators, and homes that were being produced in 1940 and 1941 would cost 20 per cent to 30 per cent more if they were being manufactured today, and will cost as much or more when we get around to peacetime business again. This is the inevitable result of higher labor rates, which affect not only the producer's labor cost, but also the cost of his materials, which, after all, are made up largely of labor.

There is no prospect that labor rates per hour will go down; the pressure will still be for still higher rates, particularly as working hours per week and overtime payments decline. The only chance for lower labor costs in postwar products is that the amount of labor—the man-hours—can be reduced by more resourceful management, better equipment, and, if possible, greater effort and efficiency on the part of labor.

There is greater opportunity for reduction of man-hours in mass-produced products, where the quantities justify the cost of labor-saving equipment and the study and planning required for its development and application. With larger machinery, produced in relatively small quantities, there is no possibility that high labor rates can be counter-balanced by low man-hour requirements. Even before the war American manufacturers of ships, power machinery, and other custom-built equipment could not sell abroad in competition with the much lower labor rates of England and the continent of Europe. The developments here during the war have made this situation still more difficult. There is no basis for expecting that American manufacturers of custom-built, heavy machinery will be able to sell their products in foreign trade unless the Government subsidizes in some way the higher labor costs.

There is, nevertheless, an extremely important postwar problem facing all American manufacturers that is wholly within their province to solve; this is the problem of replacing low-operating costs at the top of their thinking, re-

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storing low costs and expense control to the important positions they occupied in management before the necessities of war pushed them into the background. Wartime schedules, high-production volumes, and excess-profit taxes are insidious enemies of economical management if they are not watched. This is one of the intangible reconversion problems that may easily be overlooked.

Plenty has happened during the war to increase costs: wages in durable-goods industries have increased, since January 1941, 48 per cent on hourly rates and 67 per cent in weekly "take-out"; the costs of raw materials, trans-

portation, and all kinds of services have increased because of higher labor costs; Federal taxes must continue on a high level to match a postwar budget that no one has even suggested can be much, if any, under 20 billions. Demand from purchasers, which is even more potent than costs in establishing prices, is expected to be high for some years to come.

An analysis of the Westinghouse Economic Research Committee leads to the opinion that both the volume of business and the general price level will be higher following the war than they were before 1940. This follows the precedent of the first World War;

prices rose from 25 per cent to 30 per cent in one year from 1919 to 1920, and averaged over the entire 1921-1929 period, more than 40 per cent higher than the prewar level. The monetary pressure behind prices is greater today than it was during 1917-1920. More conservative economic and political thinking over the next few years is likely to increase business, financial, and consumer confidence, and lead to freer spending, active business, and higher prices. Price controls, after the war, are unlikely to do more than slow down price increases that are justified by higher costs and market demand. No wild up-surge in prices is expected, but we can reasonably expect a general postwar price level one-third to one-half above that of 1940. It is already one-fourth higher.

Compression Properties Of Sheet Metal

(Continued from page 38)

coupons gives a permanent record of each compression test.

A number of autographic stress-strain records obtained by the new method are shown in Fig. 6. The specimens were tested in compression in a Baldwin-Emery hydraulic universal testing machine and the records made by the Templin autographic recorder. Load was applied at such a rate as to produce a compression of approximately 1/16 in. per min. The range and scale were chosen to suit the requirements of the test. The abbreviation LSF stands for low range (6000 lb), full scale. The lower parts of the records are straight lines, indicating that for low loads, stress and strain are directly proportional. Where the deviation from the straight line begins the proportional limit point in compression is reached, while the points where the curves cross the straight line projection of the 0.002 in. per in. strain, mark the yield point.

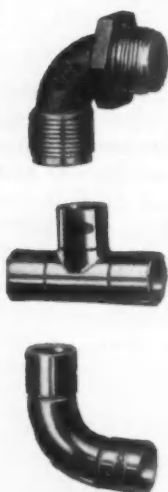
New Aircraft Developments

Development is under way on longer range fighter planes to escort new long-range bombers of the B-29 type, Maj. Gen. O. P. Echols, chief of the Army Air Forces Materiel Command, revealed in Washington recently. The P-51 and P-38 are capable of escorting B-17 and B-24 bombers to their targets but not the B-29, whose undisclosed flight radius is much greater.

General Motors has developed a new fighter plane and is tooling up to build it in one of its divisions, according to the corporation's annual report. Details cannot be revealed but the plane is of GM design and its major components, including the engine, airframe and propeller, will be GM-built.



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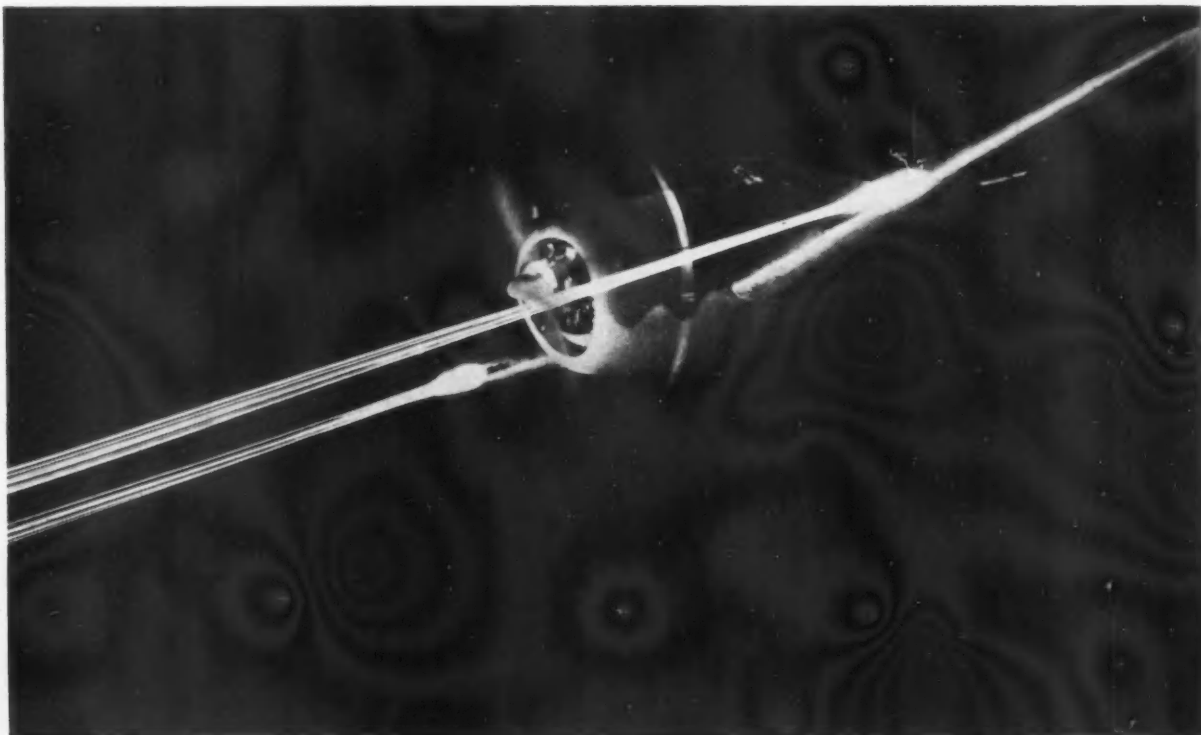


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lighter, stronger U. S. Royal Airplane tires. With the constant cooperation of the AAF, tires were built with bodies of rayon and with treads of natural and synthetic rubber. Test after test in the laboratories and in combat have proved that these new, lighter, stronger U. S. Royal Airplane tires for landing wheels and tail wheels can do that job!

when the Thunderbolt takes off...

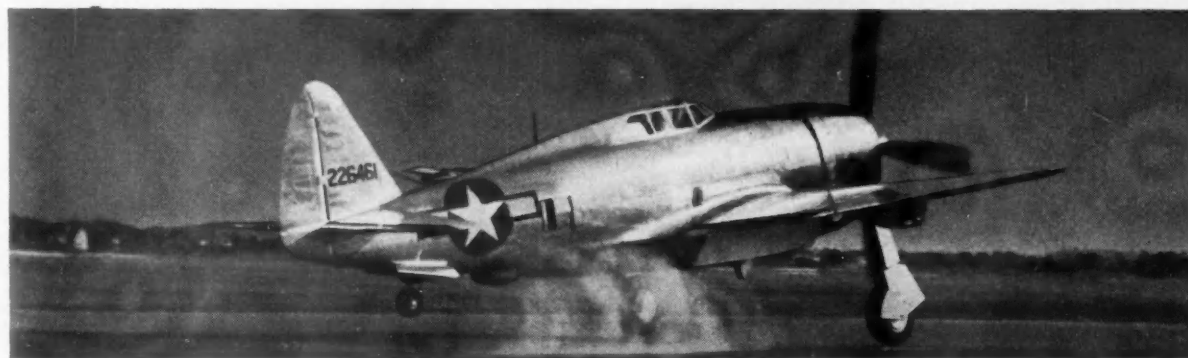


AIR-BORNE! With its full load of gas, the P-47 takes off. Under top load, the Thunderbolt's tires have done their first important job—to get this World's Heavyweight Champion Fighter away.



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BLOCK TREAD**
for landing wheels



UNITED STATES



RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

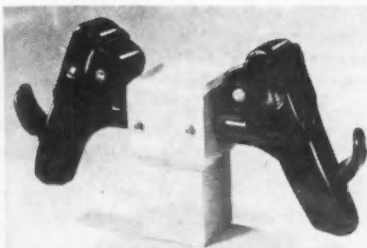
New Products for Aircraft

(Continued from page 42)

The grips are a 3-switch type, used by Naval aircraft gunners in power-driven turrets. They provide instant continuous control over gun firing, communication and turret rotation.

Each grip has three switches. The first, controlled by trigger, which is operated by index finger, is the firing trigger switch. This switch carries a heavy electrical current which eliminates the necessity for relays where the loads do not exceed 40 amp continuous or 70 amp intermittent.

The microphone switch, controlled by thumb-operated red button facing gunner, can be used either for inter-communication or high speed to accelerate the turret rotation to get guns on the target quickly. On the righthand grip it can be used for communication, for instance, and on the lefthand for high



P302 and P303 gun turret control grips

speed, or the same circuit can be operated from both grips.

The "safety" switch, controlled by spring release at base of grip, puts the turret out of action if gunner is disabled, and so prevents his fire from hitting friendly aircraft.

The P302 and P303 grips are furnished to manufacturers building Navy combat turrets.

Heated Shoe Insert Of Wool Felt

A new heated shoe insert of wool felt made by the Pioneer Products Division of General Electric Co., Bridgeport,



GE heated shoe insert

Conn., is wired in a snakelike design so that heat is disseminated evenly to all parts of the foot and ankle area. It fits inside a newly designed wool felt boot.

Generator Rex-Flex Blast Tube Assembly

This 1½-in. inside diameter Rex-Flex close pitch rib reinforced flexible segment, manufactured by Chicago



Rex Flex blast tube

Metal Hose Corporation, Maywood, Ill., has a resistance welded beaded insert attached to the extended neck.



STERLING ALUMINUM PERMANENT MOLD CASTINGS FOR ALL INDUSTRY

Sterling has for years produced fine pistons by using a unique and proven, patented molding process, fine quality materials, and unsurpassed skill in workmanship.

In addition to our piston factory, we are just completing a very modern foundry that will produce all types of aluminum permanent mold castings.

Our staff of engineers will be glad to assist you with your engineering problems. Their experience may be valuable to you.



STERLING ALUMINUM PRODUCTS Inc., St. Louis 6, Mo.

New Products

(Continued from page 44)

long as the controls connected to the input grid circuit of the electronic tube remain open. The instant these contacts close, the relay is de-energized. A built-in time delay feature prevents chattering when the contacts in the input circuit are momentarily closed. A contact arrangement on the electromagnetic relay permits the device to be used either to make or break a load circuit when the actuating contacts

connected to the input circuit on the electronic relay are closed.

Protective Skin Cream in Two Types

The name Clad has been given to its line of protective skin creams by The B. F. Goodrich Company, Akron, Ohio. Clad is made in two types, for dry and for wet working conditions.

The dry cream is of an improved type which has been made as nearly neutral to the skin as possible. These properties eliminate skin drying or any tendency to cause burning or irritation even under prolonged usage.

Use of the dry cream protects exposed portions of the body against dirt, grease, grime and any other hard-to-wash-off substances. The company claims that it provides maximum protection and safety.

The cream for wet use is made for protection of the skin where water and other dilute aqueous and mild chemical solutions are present. Both the wet and dry types leave the skin soft and smooth even after the cream is removed.



ACADIA Synthetic SHEETS, EXTRUSIONS AND MOLDED PARTS

While chemically synthesizing rubber atom by atom, Acadia builds into it the particular qualities dictated by the end use.

Acadia Synthetic Products is working hand in hand with aircraft designers and manufacturers, producing sheets and shapes of synthetic rubber for packing, diaphragms, grommets, ring seals, bushings, chafing strips, etc. Each part is particularly qualified for the service it will see.

Acadia engineers are prepared to work with you on applications to fit your product. Write us today for further information.



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Bronze Faced Steel Pistons

In making special pistons for Cleveland Pneumatic Aerol, Inc., division of the Cleveland Pneumatic Tool Company, the Neo Mold Company of Cleveland has developed a new method of producing bronze faced pistons. This method involves flame spraying of bronze on steel, and its successful application by the Neo Mold process is said to be the first of its kind. Compar-



Bronze faced pistons

atively light steel blanks are sprayed with a special bronze alloy to a thickness of approximately .045 in. on the bearing surface. This is rough machined in the initial production, then given the required high finish, with oil grooves, in the Aerol plant. These strut pistons, which are used on the Aerol landing strut with which P47 planes are equipped, were formerly machined from bronze castings. In the new process, some 3½ lb of bronze is saved on each piston, and the finished product is lighter than the old pistons.

Duralon, a New Basic Resin

The U. S. Stoneware Company, Akron, Ohio, is introducing a new basic resin. This resin, named Duralon, a furane derivative, is said to be characterized by the lowest water absorption of any organic resin, insolubility (after activation) in any solvent or combination of solvents, high electrical resistivity, absolute stability in storage

PAGE *Welding* ELECTRODES

THEY HAVE
TO BE GOOD

MAKING electrodes is highly technical work.

Analysis of the wire—type, thickness, hardness and concentricity of the coating—all chemical and physical characteristics must be held to close tolerances to insure uniform welds and satisfactory production.

To you, the very fact that **PAGE WELDING ELECTRODES** have been hard to get is *proof* that they measure up to the highest standards. Here's why:

PAGE has been turning out a bigger tonnage of electrodes than ever before in **PAGE** history. And they have *all* been used on work that had to pass the closest scrutiny of Army, Navy and Air Corps inspectors. They have *had to be good!*

As more and more of **PAGE'S** volume begins to flow into civilian manufacturing, it will become evident that **PAGE** is making even better welding electrodes—of all types—than ever before. That's why it will pay you to *get in touch with PAGE.*

Ask the local **PAGE** distributor about **PAGE** Hi-Tensile "C" Electrodes—as well as the complete range of **PAGE-Allegheny** Stainless Steel Electrodes.



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and handling, and by ease of workability.

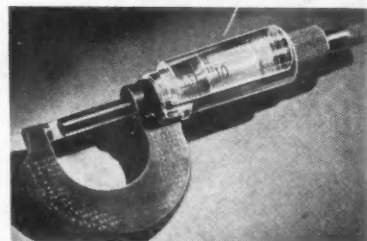
Duralon resin, in its pure form, is a heavy, viscous liquid, dark maroon in color. On incorporation of catalysts and application of mild heat Duralon reverts to an extremely hard, dense, black substance. Varying physical, chemical and electrical properties can be developed in the base resin by incorporation of the usual fillers and lubricants. In certain stages Duralon can be readily machined by drilling, milling, turning, sanding or grinding. Duralon resins are readily soluble, before activation, in many inexpensive

hydrocarbons, as well as in ketones and chlorinated solvents.

While preliminary studies by the manufacturer indicate that Duralon possesses definite molding possibilities, its immediate importance is as an impregnating agent, as a laminating and bonding agent, or as a protective coating material.

Micrometer Scale Magnifier

The Stebar Magna-Eye, a product of Stebar Mechanical & Electrical Research Laboratory, Minneapolis, Minn., is made of transparent methyl-methac-



Stebar Magna-Eye

rylate and protects micrometers from dust as well as magnifying the numbers and divisions on the scale. Its light gathering properties are said to render the scale plainly visible in poorly lighted places.

Colloidal Latex of Vinyl Chloride Resin

Creation of a true colloidal latex of one of its Geon vinyl chloride resins in water, without the use of any organic solvents, is announced by the B. F. Goodrich Company, Akron, Ohio. The Geon dispersion resembles rubber latex in appearance. Vinyl resin particles held in stable suspension in the latex are so minute that 25 trillion are present in a cubic inch. The new latex is under allocation by the War Production Board. Quantities for experimental use are available, however.

Adaptable to a wide variety of applications in coating textiles, wire and other materials, and film manufacture, the latex is said to alloy all the advantageous properties of the vinyl resin to be utilized without the expense and hazards of flammable and toxic solvents necessary in older methods. It also permits use of much existing equipment which cannot handle other forms of vinyl resins, and eliminates the necessity for expensive recovery systems required where these resins are applied from solution.

The new latex in clear or colored form can be brushed, sprayed or dipped. Upon deposit, at the end of the drying cycle, the latex is fused almost instantaneously at temperatures of 275 to 300 F to yield flexible, tough, stable, resistant coatings or films.

Optical Flats of Brazilian Quartz

Greater wearability and lower coefficient of expansion are claimed for the new Doall optical flats manufactured by Continental Machines, Inc., Minne-



Doall optical flats

Remember

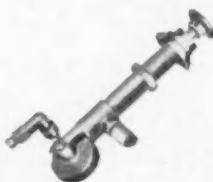
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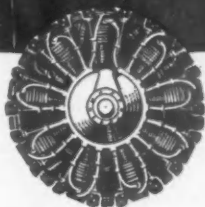
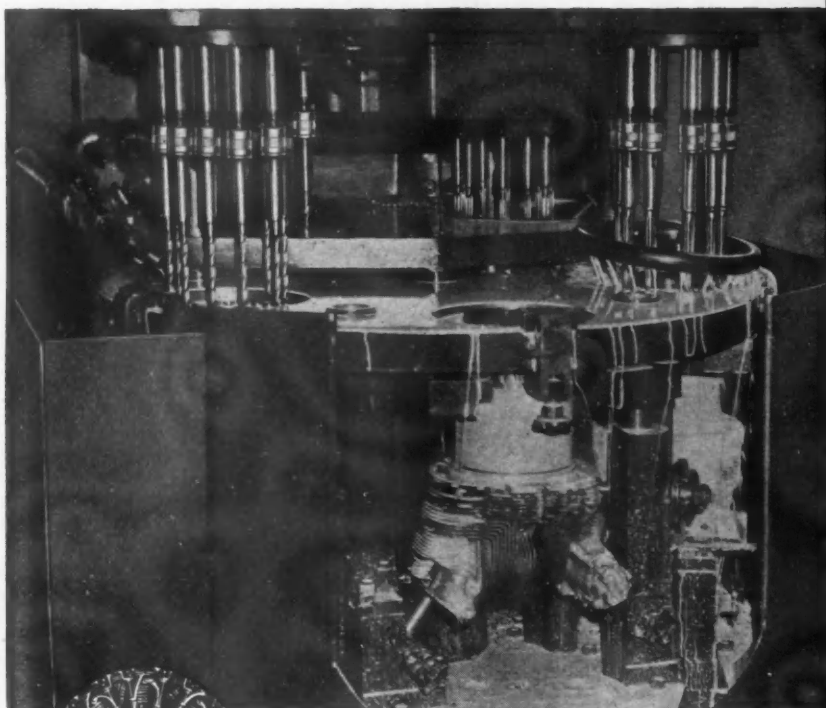
40 FLOATING HOLDERS and what they do*

What Gairing Floating Holders do for Wright is indicated below . . . what they *always* do when given an opportunity is a story that every machine tool production man and every operator should know and *understand*.

And that's easy, for if you understand the action of a universal joint, you will understand the action of a Gairing Full Floating Holder.

All of which means that when a self-contained fixture holding the work is set, the cutting tool held by a Gairing Full Floating Holder can't go wrong *regardless of any misalignment with the machine spindle*. It can't go wrong because the universal joint action eliminates side strain or any urge to one side of the bushing. The net result is that accuracy is maintained.

Gairing Floating Holders are quickly applied to any spindle, take cutting tools just as quickly. To ignore their value is a net loss.



*Forty Gairing Full Floating Holders, equipped with the necessary cutting tools, drill and ream twenty holes in the cylinder barrel flanges of Wright Aircraft Engines. The machine is equipped with an automatic five position index.

GAIRING

The Gairing Tool Company, Detroit 32, Mich.
Manufacturers of Standard, Special and
Gair-Lock Inserted Blade Cutting Tools

apolis, Minn. These Doall optical flats are made from fused Brazilian quartz which has a hardness of seven on the Moh scale. Having a lower coefficient of expansion than pyrex or optical grade glass, Doall optical flats are said to remain flat even after considerable handling.

Six sizes in diameters of 2, 3, 4, 5, 6 and 10 in. are available, each flat being packaged in a hardwood case. Doall optical flats are available with the following grades of accuracy: one millionth accuracy for laboratory gage block and instrument inspection, two millionths for checking instruments and fine tools.

Countersink for Use in Close Quarters

To permit countersinking in close quarters, a new microset stop countersink, Model 400-A, with cutaway skirt is now in production at Aircraft Tools, Inc., Los Angeles, Cal. The cutaway skirt feature makes it possible to countersink in corners, next to joints, and on plate nuts.

The new Aircraft Tools model incorporates features such as split collet-type shaft, full ball thrust bearing, positive sight adjustment in increments of .002 in., lock spring in sight adjusting sleeve that holds locking teeth in



Model 400-A countersink

set position, and pin that positively locks stop collar to shaft.

Coated Electrode for Welding Aluminum

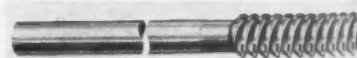
Eutectic Welding Alloys Company, New York, N. Y., is introducing a coated electrode for use in the welding of aluminum sheet and castings. The maker claims that with this rod, known as EutecTrode 2100, it is possible to add metal without completely pre-heating castings and without danger of overheating the metal adjacent to the weld. A special coating on the rod permits its application even without pre-heating. EutecTrode 2100 is available in 1/8, 5/32 and 3/16-in. sizes.

New Line of Diamond Wheels

Industrial Abrasives, Inc., Chicago, Ill., is manufacturing diamond wheels in which the diamonds are said to be firmly and securely locked by the use of Zurium. The makers state that the new bonding principle has been perfected by the use of Zurium which has already proven successful in the Super Cut diamond wheels. Reports by the company indicate unusually long life for these wheels.

Rotary Broach to Replace Reamer

A new tool, called a rotary broach, is being introduced by the Shearcut Tool Company, Beverly Hills, Cal. Shearmaster rotary broaches may be used in any machine to take the place of a reamer. The manufacturer claims this new tool gives results superior to those obtained by reaming, and also says that Shearmaster rotary broaches should be mounted in a floating holder



Shearmaster rotary broach

in order to secure the accurate holes that are produced when the tool is properly used.

The rotary broaches are being supplied, with straight shanks only, in sizes from 1/4 in. to 1 in. by sixteenths of an inch, and from 1 1/8 in. to 1 1/2 in. by eighths of an inch.

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FLUSH PIN GAGE

CENTRALITY GAGE

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RIGHT WHERE THE WEAR COMES

NOTICE the toe and heel of your socks. Now, notice the construction of Titeflex oil and fuel lines. Both are re-inforced — and for exactly the same reason: to withstand long, hard wear, right where the greatest wear comes.

At the top of each convolution, Titeflex provides not one, but four thicknesses of metal. But that's not all — Titeflex is completely metal — not affected by gas, oil or liquids — not damaged by high temperatures. It's fully flexible — stands excessive amounts of vibration. Titeflex is inherently leak-proof — even under high pressure. Titeflex lines

are built to last. Even the outer braid is woven *onto* the tubing (not slipped on after it is made) to provide greater durability, greater strength.

On many a tank, jeep, truck or other vehicle in the war effort, Titeflex fuel lines are today demonstrating these superior qualities — and their resulting economy. It's not too soon to learn how these same qualities can be applied to your production. Let our engineers give you the facts, without obligation, of course.

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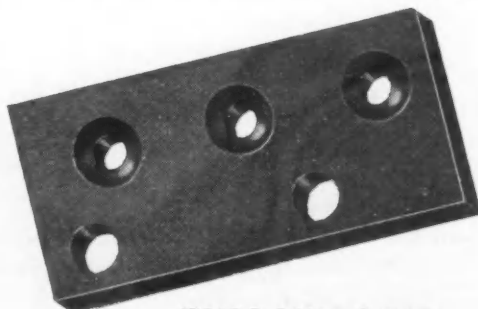
Titeflex

VITAL CONTROLS ARE C-D INSULATED



THIS DILECTO

part is used to identify connections as well as to mount and to insulate them. Good mechanical and electrical properties are needed.



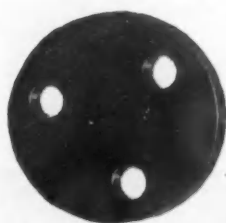
THIS VULCOID

part must resist carbon deposit from arcs as well as prove equal to mechanical shock and also retain its electrical insulating properties under adverse conditions.



THIS CELORON

part had to be of a material that could be molded to shape, that was a good insulator and strong.



THIS DILECTENE

part must remain stable over a wide range of frequencies and in spite of humidity conditions.



THIS DIAMOND FIBRE

part had to be of a material that could be deep drawn, that was resilient, tough and oil resistant.



CONTINENTAL-DIAMOND manufactures Electrical Insulating Materials that are engineered to meet specific electrical, as well as mechanical and thermal conditions. That's why C-D products are used in all types of Military Equipment where possibility of failure must be reduced to a minimum.

WHAT MATERIAL?

C-D technicians will be glad to help you answer this problem. Send for bulletin GF.

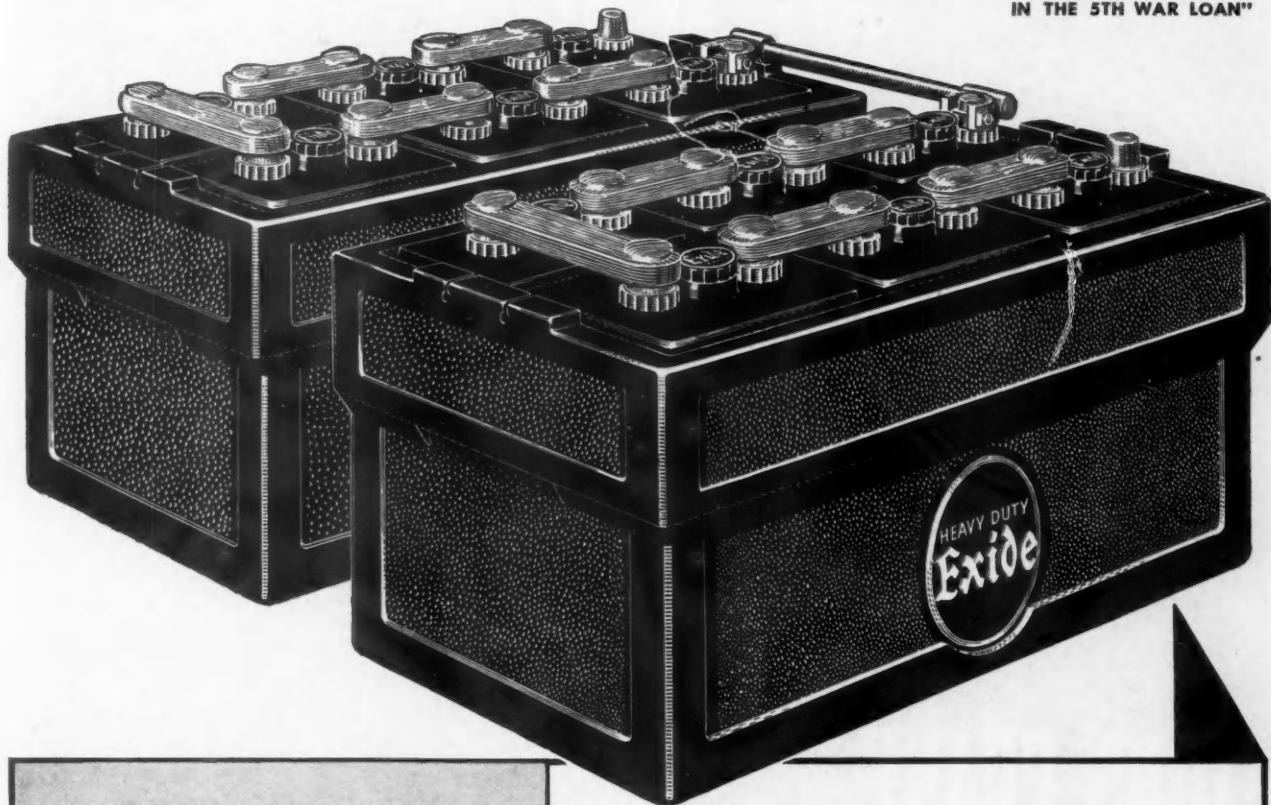
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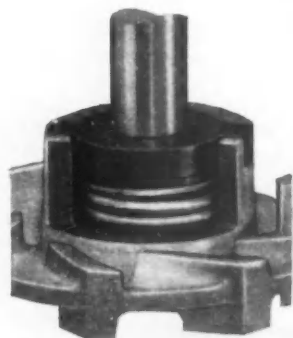
"SIMPLEST . . . EASIEST
TO INSTALL!"

Illustration shows range
of production sizes of
John Crane Bellows Seal

JOHN CRANE *Bellows* PUMP SEAL

Standard Equipment in Coolant Pumps on Jeeps—Tanks—Trucks—Aircraft

Millions of JOHN CRANE Bellows Seals are serving the nation in Jeep, Tank, Aircraft and Automotive Coolant Pumps.



Seal and Washer in Operating
Position (Under Load).

This Seal is simple in design; consists of a Flexible Synthetic Rubber Bellows and a Helical Spring assembled as a unit. The Seal and a Wearing Washer revolve with the pump impeller—the Washer

takes the wear. The Bellows flexes easily to adjust for wear, and the Spring always provides proper sealing pressure.

The Assembled Unit can't be put in wrong, for the two ends are identical—either end is "right". It seals on the end flanges, not on the shaft, and slides on freely. Available in sizes for 5/16" to 1 1/4" shafts.

(The John Crane Bellows Seal is not designed to replace conventional grease retainers or oil seals.)

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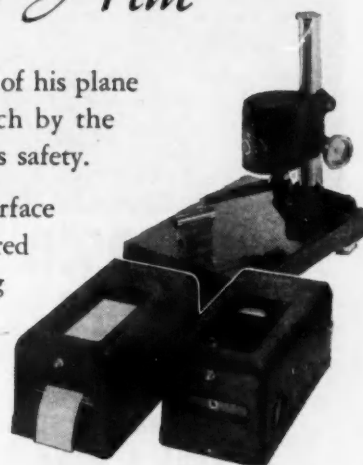


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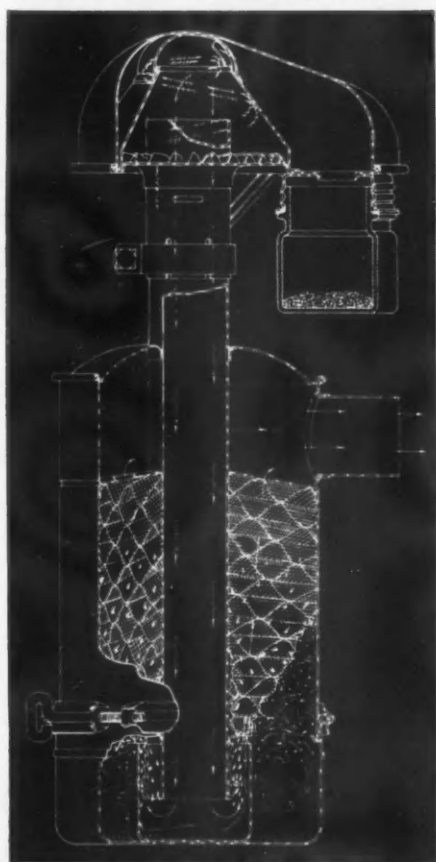
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These machines must be kept fighting, kept producing munitions, kept producing food at peak efficiency. By providing positive protection against abrasive dust and grit, the worst enemies of engine life and performance, Donaldson Oil Washed Air Cleaners are performing a vital function on combat vehicles of many kinds, industrial power units, and farm tractors.

A neglected Air Cleaner means a neglected engine. It is your patriotic duty to give your air cleaners the reasonable care they need so that they will continue to deliver only clean, pure air to your engines, prolonging their life and operating efficiency.

SERVICE YOUR AIR CLEANER DAILY. Remove oil cup—empty oil—scrape out dirt—fill to oil level bead with engine oil. It's a simple, quick, but vital operation!

Educational Film Loaned to Interested Groups

The Donaldson Company has prepared a film entitled "Cleaned Air—No Wear". It shows clearly and in detail how the Donaldson Oil Washed Air Cleaner functions and how to service it properly. Implement dealers, schools, Farm Bureaus, and others will find this film of great practical value and are invited to write for it. There is no charge—no obligation. This film is a part of the Donaldson Company's contribution toward keeping America's tractors and power units producing for victory!

DONALDSON Oil-Washed AIR CLEANERS

BAKELITE

TRADE-MARK



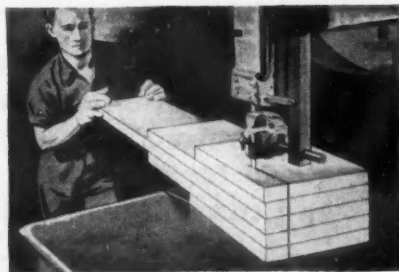
DENSIFIED WOOD—a New Product for Industry

This airplane propeller blade for training planes is made from densified wood. This is a remarkable new industrial material that consists of layers of wood impregnated and bonded with BAKELITE resins, and compressed into a dense, strong, and lightweight structure.

To make these blades, thin veneers of maple are soaked in BAKELITE phenol resin solution. The impregnated veneers are then compressed in a hydraulic hot press into $1\frac{1}{4}$ inch planks. The planks are then laid up into the rough shape of a propeller at which point high-frequency heat and pressure are applied. And out comes a single block of densified wood,

such as shown below—from which the propeller blank is rough-cut and then finished into the blade you see here.

Densified wood has an extremely favorable strength-weight ratio, offering high



mechanical strength combined with relatively low specific gravity. This combination of properties, so vital to efficient aircraft operation, may provide the answers to some of your own product design problems. Densified wood will some day be an important industrial material for peacetime developments. Write Department 27 for names of fabricators equipped to supply information and samples.

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Every report of another Allied victory is proof that America's great automotive industry is making good as an important part of the Arsenal of Democracy. Every tank and gun and plane which America is pouring onto the battlefronts around the globe is evidence of the industry's productive energy, engineering skill and daring vision.

This record of the industry at war is the best possible indication of what that same industry can do for a peacetime America. Someday soon, we hope, its designers and engineers will be turning to peacetime production problems.

Auto-Lite, working shoulder to shoulder with the automotive industry, is contributing to America's war production. The job ahead for peacetime is fully as important and Auto-Lite will help get that job done too.

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In the Mines and On the Highways...*



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**CLECO Pneumatic Tools speed production in metal-working plants. AEROLS (the shock absorbing landing gear used so universally on aircraft) insure safe, smooth landings and take-offs. CLEVELAND Rock Drills are widely used in the mining and contracting fields. CLE-AIR Shock Absorbers protect buses, trucks and trailers from road shocks.*

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Fleet superintendents responsible for hauling critical materials aren't taking chances with bearings these days. They're having their mechanics check moving parts regularly. They're replacing with **SKF** Bearings. And for bearing problems beyond their ken, they're calling in their Authorized **SKF** Distributor — trouble shooter of the bearing industry. He doesn't always have just the bearing required, but he can often suggest a substitute until the right one arrives. Your **SKF** Distributor is an important part of your engineering staff. Make use of him. 5445

SKF INDUSTRIES, INC., PHILADELPHIA 34, PA.

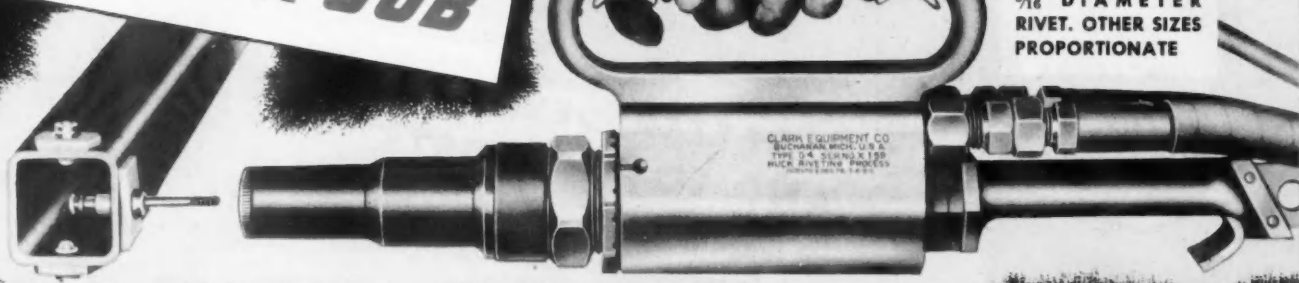


CLARK *Blind* RIVETING PROCESS

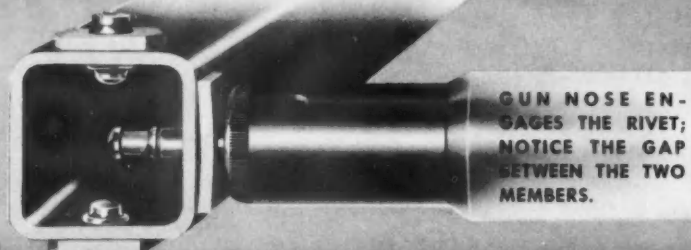
*does a
BETTER JOB*

WELL BALANCED,
HYDRAULICALLY
ACTUATED RIVET
GUN. EXERTS A 4-
TON PULL TO SET A
 $\frac{5}{16}$ " DIAMETER
RIVET. OTHER SIZES
PROPORTIONATE

1



2



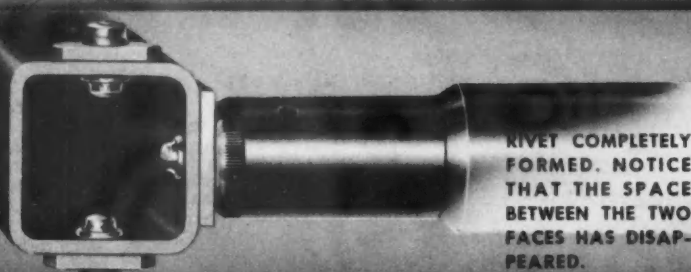
GUN NOSE EN-
GAGES THE RIVET;
NOTICE THE GAP
BETWEEN THE TWO
MEMBERS.

3



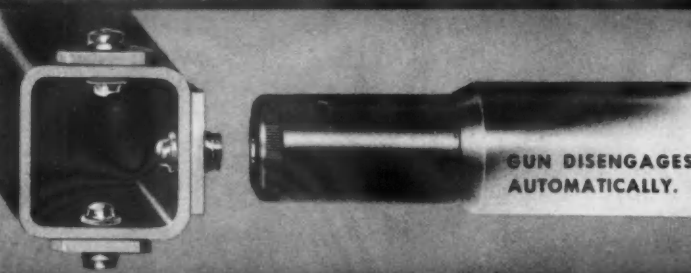
FORMATION OF
THE RIVET STARTS
WHEN TRIGGER IS
PRESSED.

4



RIVET COMPLETELY
FORMED. NOTICE
THAT THE SPACE
BETWEEN THE TWO
FACES HAS DISAP-
PEARED.

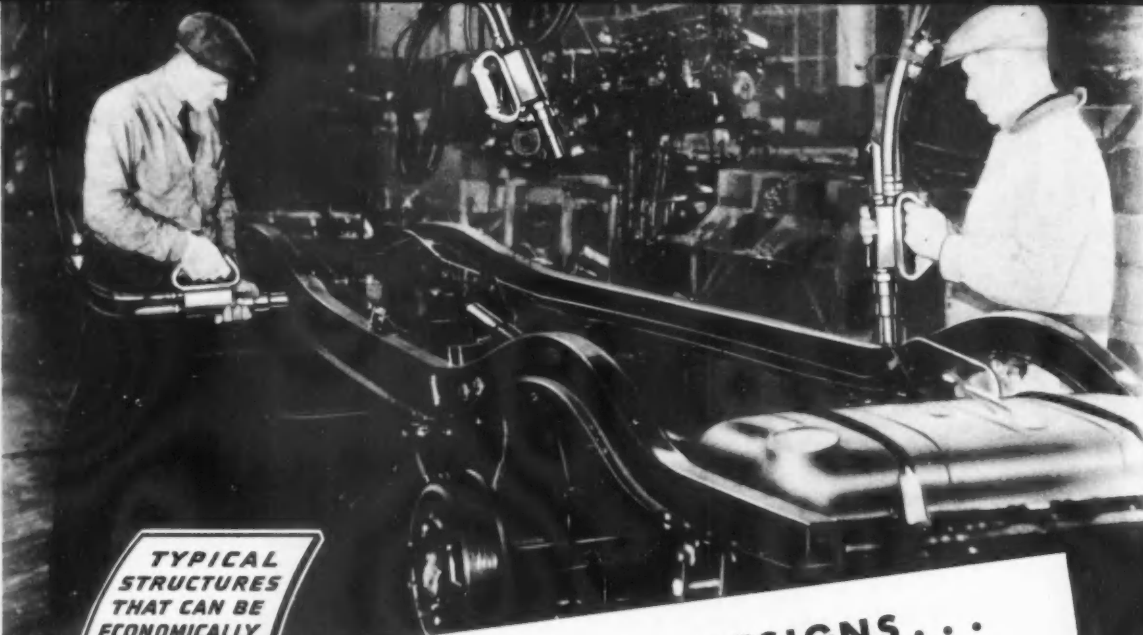
5



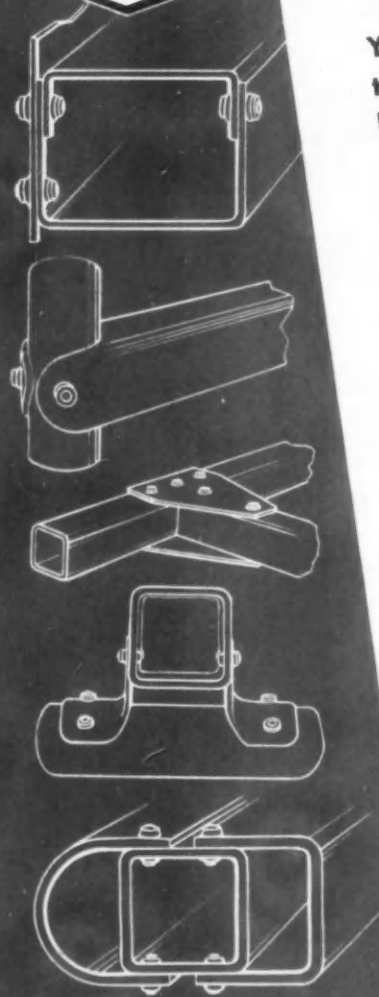
GUN DISENGAGES
AUTOMATICALLY.

THE PIONEER BLIND RIVET
—FOR 10 YEARS A STAND-BY
IN THE AUTOMOTIVE AND
RELATED INDUSTRIES . . .
DRIVEN FROM ONE SIDE—
WITHOUT NOISE . . . IT TAKES
ONLY A SECOND TO DRIVE
A CLARK BLIND RIVET . . .
DEFINITELY STRONGER THAN
CONVENTIONAL RIVETS—
PARTICULARLY IN SHEAR . . .

*Another
PRODUCT of*
CLARK
EQUIPMENT
COMPANY



**TYPICAL
STRUCTURES
THAT CAN BE
ECONOMICALLY
ASSEMBLED
WITH CLARK
PROCESS**



FOR BETTER DESIGNS... AND LOWER COSTS

You can make important savings in assembly time and in production Costs by using Clark Blind Rivets.

One user—in the railroad industry—achieved a production of more than 500 Clark blind rivets per man-hour. Another—a trailer manufacturer—processed twice as many units as before in the same floor space: by changing to Clark blind rivets.

In addition to these savings you'll see what extraordinary opportunities this time proven process creates in the field of product design. As a means of assembly, this type of riveting removes many restrictions which previously limited the designing engineer to structures that could be assembled only by conventional methods. In contrast, with the Clark Huck Process, there is unlimited opportunity for simpler, more practical designs; for lighter, stronger, more rigid construction; for faster, easier lower cost assembly. Riveting members to hollow units becomes as simple as drilling a hole.

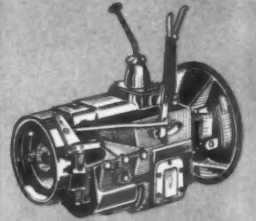
It is easy to find out how you, too, can benefit by using Clark Blind Rivets. Simply draw upon Clark engineers' rich and varied experience—at your service, on request.

CLARK EQUIPMENT COMPANY
BUCHANAN, MICHIGAN

Also BATTLE CREEK . . . JACKSON BERRIEN SPRINGS, MICH.



Some
CLARK
products



TRANSMISSIONS



BLIND RIVETING PROCESS



AXLE HOUSINGS



FRONT AND REAR AXLES
FOR TRUCKS AND BUSES



DRILLS AND REAMERS



GEARS AND FORGINGS



ELECTRIC STEEL CASTINGS



INDUSTRIAL TRUCKS
AND TRACTORS



RAILWAY CAR TRUCKS



METAL SPOKE WHEELS

CLARK *Blind* **RIVETING
PROCESS**

ACCURATE

REMOTE CONTROL

in a simple, easily-applied SINGLE TUBE system

Over 60,000
EXACTORS

prove the effectiveness
and dependability of this
single-tube, hydraulic
system.

THE SPERRY **EXACTOR**

HYDRAULIC REMOTE CONTROL

saves engineering effort, installation time and material

Here's what the Sperry EXACTOR offers Design Engineers who are looking for an *accurate, time-saving, and effective* device to solve their remote control problems:

**SIMPLE APPLICATION,
FLEXIBLE INSTALLATION**

A SINGLE TUBE — easily bent to fit installation requirements — eliminates design problems usually encountered with mechanical linkages and other control systems. Just bend the tube around obstacles. Forget pulleys, bellcranks, etc.

ACCURATE AND SELF-CONTAINED

Accurate to a fraction of a degree through 55° motion. Instant control, without backlash. You get positive and reliable action without the need of auxiliary power. Vibration proof. Means is provided for periodic temperature compensation. Capacity 400 inch-pounds in one direction and 100 inch-pounds on the return.

**EASY TO MAINTAIN
AND SERVICE**

Occasional checking of oil level is the maximum maintenance generally required over the 500,000 cycle life of the control.

ENGINEERING SERVICE

Sperry Engineers offer you their experience and data *gained over 10 years* of EXACTOR research on thousands of applications to Aircraft, Marine and Industrial equipment.

Fill out and mail
the coupon for
further information.
No obligation.

SPERRY
PRODUCTS
INC.

USE THIS COUPON FOR PROMPT REPLY

SPERRY PRODUCTS, INC.
Hoboken, New Jersey

AAI-EHC544

Gentlemen:

Please mail me, without obligation, literature on the Sperry EXACTOR Hydraulic Control.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

Symbols of Freedom



Musket and Powder Horn, 1775 . . . the soldier who carried these in the revolutionary war helped make America free. Perhaps he loved freedom . . . although it is possible that he took up arms because of a recruiting poster of the period which promised: "A bounty of TWELVE dollars, together with SIXTY dollars a year in gold and silver on account of pay."



- *United States War Bonds, 1944* . . . purchase of these to the limit of your resources will help keep America free. If more than patriotism or love of freedom is needed, there is that "bounty" of TWENTY-FIVE dollars on every seventy-five dollars invested in the finest "securities" on the market today.

Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, are making precision parts for guns, airplane engines and other matériel of war. They also make the original, patented R-B interchangeable Punch and Die; sheet metal dies; plastic molds, jigs and fixtures, cold forged parts; and other special products. All four plants have now added a star to their Army-Navy "E" pennants.

ALLIED PRODUCTS CORPORATION
Executive Offices: 4646 Lawton Ave., Detroit 8, Michigan



Let's All Back The Attack



Bombs away!

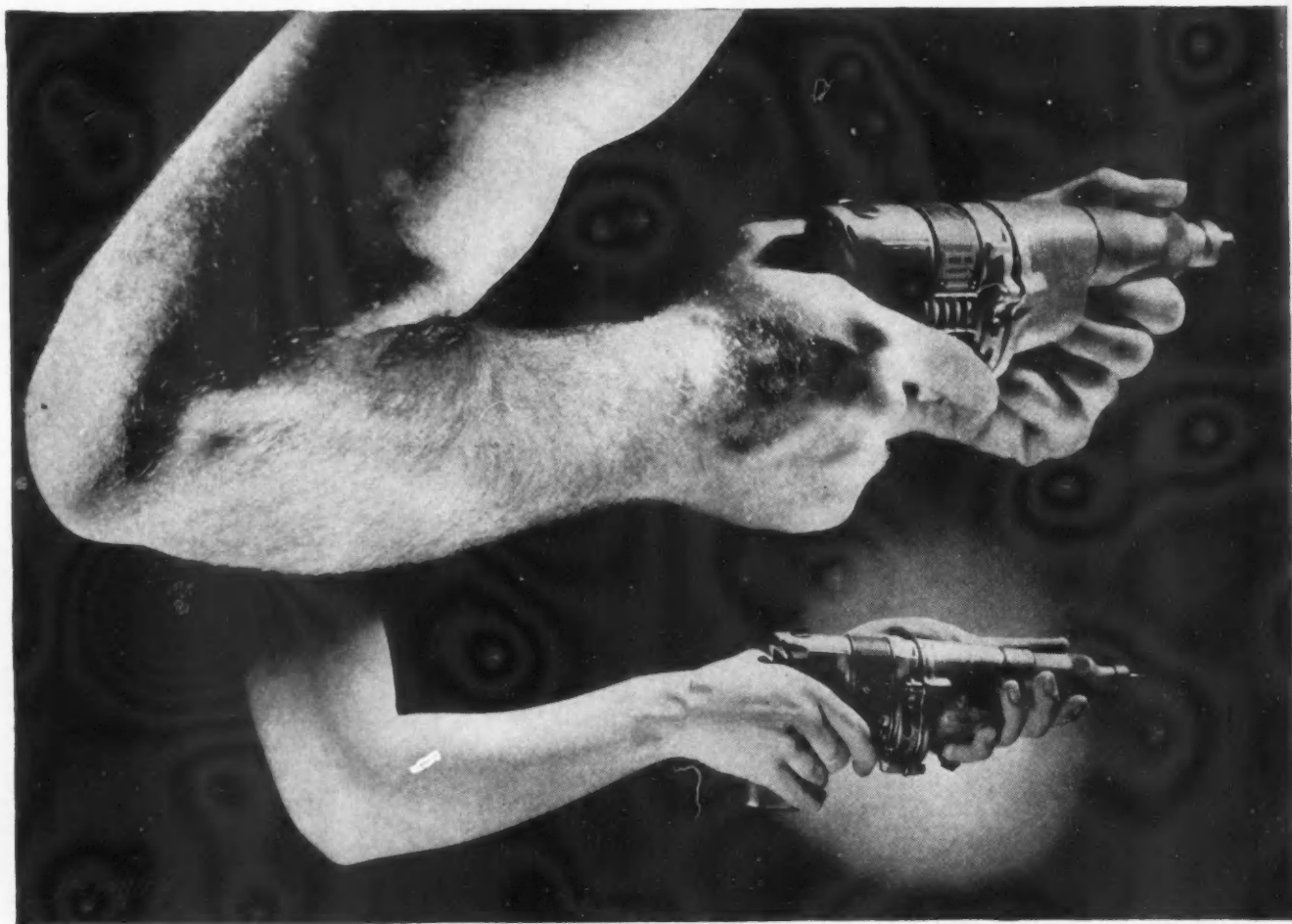
The whole bombing program which is so effectively smashing away at the war potential of the enemy relies to a great extent on alloy steels developed since the start of the war emergency.

In bombers and fighters both, NE steels are now doing hundreds of vital jobs that were once handled by the old-line alloys. For example, NE 9440, NE 8720, and NE 8630 are being used for vital parts of aircraft engines, frames, and bomb components.

These are, of course, only a few in the long list of places where NE steels are giving an excellent performance in fighting equipment.

A vast amount of research on wartime steels has been done by Bethlehem metallurgists—research that has included the most exhaustive laboratory tests. If you have a problem involving analyses, properties, heat treating, or applications, write Bethlehem Steel Company, Bethlehem, Pa.

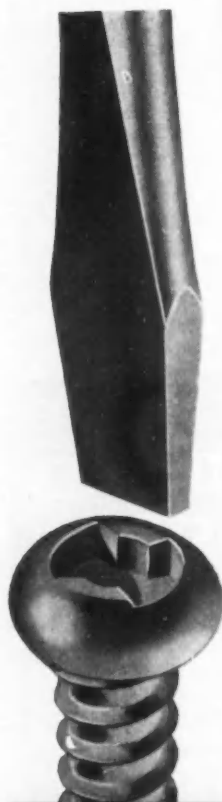




Compare The Effortless Ease

with which CLUTCH HEAD Screws are driven home . . . *employing the substitution of method for muscle* . . . with definite output gain at the end of the day. The explanation is simple. With the straight-walled Clutch recess, matched by the straight sides of the Type "A" Bit, there is no "ride-out" tendency and, therefore, no need for strenuous end pressure. This exclusive CLUTCH HEAD feature eliminates the fatigue factor set up by end pressure. In addition, the wide Clutch of this modern screw develops speed and confidence in line assembly work by presenting a safe, easy-to-hit target.

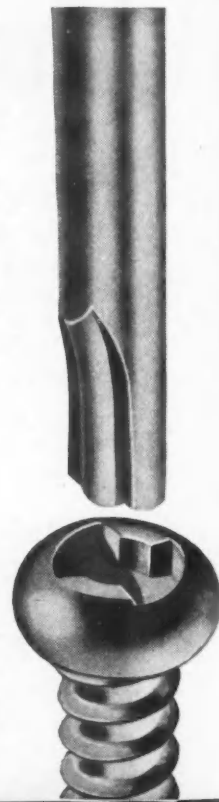
CLUTCH HEAD contributes so many outstanding exclusive advantages for faster, better, safer, and lower cost production that it has come to be accepted as "The Screw That Sells Itself." You may demonstrate this to your own satisfaction by asking us to mail you package assortment of CLUTCH HEAD Screws and sample of the Type "A" Bit.



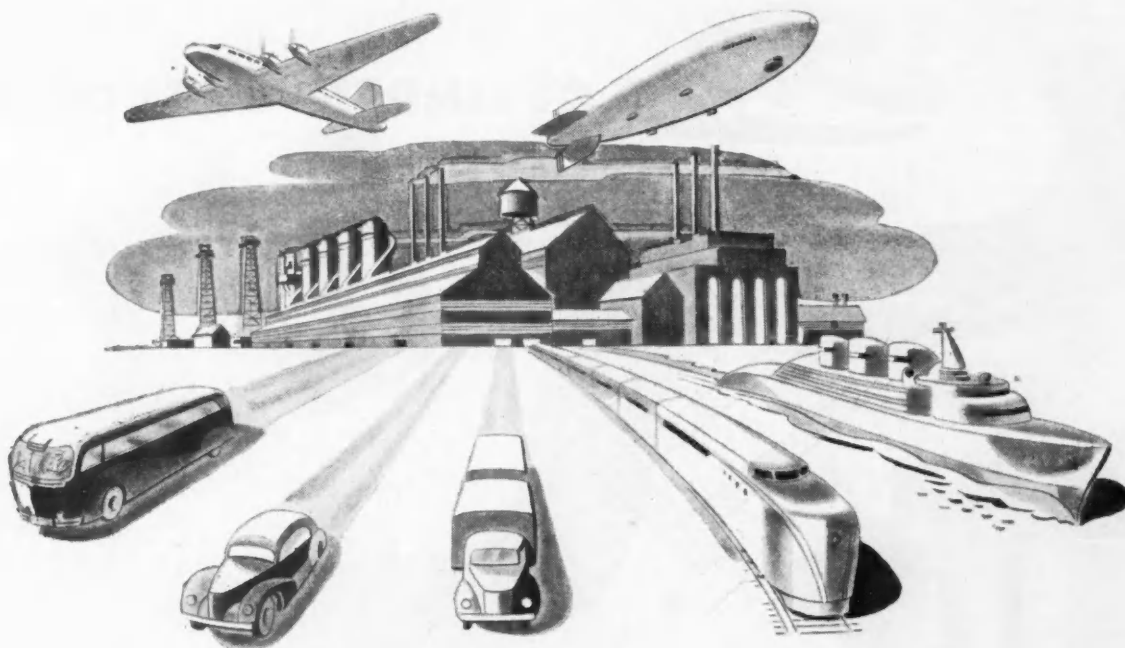
The fact that CLUTCH HEAD Screws operate with the ordinary type screwdriver simplifies problems of field service. This feature has proved its value in many phases of the war effort. This modern screw is available in Standard and Thread-forming types for every purpose.



This rugged Type "A" Bit delivers long uninterrupted service. A brief application of the end surface to a grinding wheel restores original efficiency. No delay, and no "back-to-the-factory" shipment for reconditioning.



UNITED SCREW AND BOLT CORPORATION
CHICAGO CLEVELAND NEW YORK



FLUID POWER ENGINEERING *by Parker*

FLUID POWER

Confine fluid in a closed system, apply power at one end, and you deliver power instantly at the other end.

That is Fluid Power—based on hydraulics—the 1944 way to get work done. Any kind of work—hard or easy, brutal or delicate. Precisely-timed work or remote-controlled work.

You can step Fluid Power up or step it down—to lift a tank or wind a watch. You can make it fit the job. You can flow it around corners and into tight places. You can regulate it, by valves, within precise limits.

TRANSMITTING FLUID POWER

Fluid Power is transmitted through tubes; it needs no shafts, gears, pulleys or belts. Tubes themselves are simple devices, easy to cut, bend, join or put in place.

But when a system of tubes is used to transmit Fluid Power, it calls for wrinkle-free bends, leak-proof fittings, precise operating valves, flow without obstruction. It gets to be an engineering job.

An interesting booklet, giving you more facts about Fluid Power, will be sent on request. Address Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

FLUID POWER ENGINEERING

That's been Parker's business for twenty years—designing Fluid Power tubing systems, engineering them, building valves and fittings, and making fabricating tools. Often we do the fabricating, too.

War demands have made industry more and more aware of the great number of things Fluid Power can do. For us, that has been the basis of a healthy growth in experience and knowledge, and the variety of our products.

Today, you'll find Parker-engineered Fluid Power systems in refrigerators and bombers, in chemical plants and locomotives—everywhere in industry.

LOOKING AHEAD

With at least one eye on the future, wouldn't you like to talk this through now with a Parker engineer? No matter what you make, or what kind of machines you operate, you are likely to find some interesting possibilities in the Fluid Power idea.

PARKER

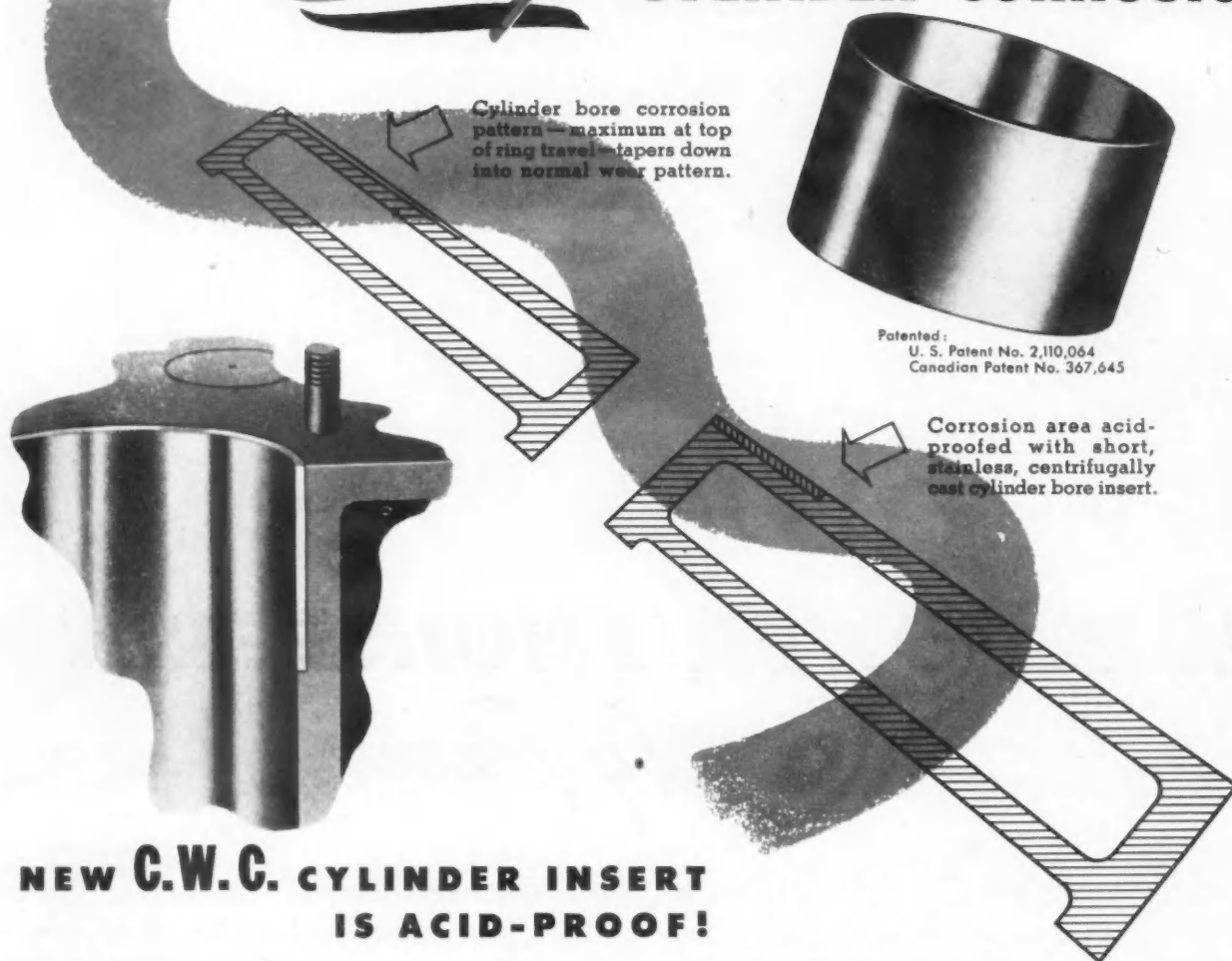
APPLIANCE COMPANY

CLEVELAND • LOS ANGELES

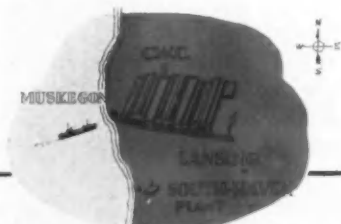
FLUID POWER ENGINEERING

Stop

CYLINDER CORROSION



NEW C.W.C. CYLINDER INSERT IS ACID-PROOF!



CAMPBELL, WYANT & CANNON

Six foundries in four cities:

Muskegon—Henry Street Plant
Sanford Street Plant
C. W. C. Crankshaft Corporation.

South Haven—National Motor Castings Co.

Lansing—Centrifugal Fusing Co.

Bettendorf, Ia.—Ordinance Steel Foundry Co.

**INDUSTRY'S LEADING CONTRACT
FOUNDRY ORGANIZATION**

The most important cause of wear in the ring-swept area of automobile engine cylinders is the corrosion resulting from the acid by-products of combustion. The severity of such corrosion-induced wear is greatly increased by certain abnormal operating conditions—oil contamination—insufficient crankcase ventilation—inadequate lubrication—excessive blow-by and improper functioning of thermostatic controls. This problem has been solved by C.W.C.'s latest contribution to automotive progress—a short, stainless, acid-proof cylinder insert, centrifugally cast of C.W.C. electric furnace alloyed metal.

You can prevent cylinder wear caused by corrosion in your engine. Write or wire now so that C.W.C. engineers and metallurgists may bring their experience to bear as quickly as possible upon your cylinder corrosion problems.

We have reprinted Alex Taub's interesting, informative article "Cylinder Bore Wear and Corrosion" from the March 1 issue of *Automotive and Aviation Industries*. Your request will bring a copy immediately.



CAMPBELL, WYANT & CANNON FOUNDRY CO.

MUSKEGON, MICHIGAN

TO MANUFACTURERS

whose postwar plans call for long runs of a given part

You will want your after-war parts sources to have:

The ability and skill to work to close tolerances.

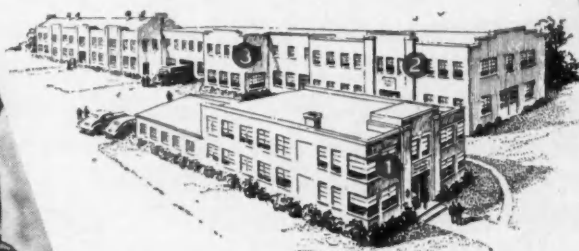
An efficient setup for uniform production of long runs.

Capacity and reliability to insure prompt deliveries.

Experience in adapting new skills and new materials to your parts needs.

Whether your production plans call for forgings, castings or plastics, we believe that Brake Shoe plants plus Brake Shoe Research can be of practical assistance.

If this interests you, write R. B. Parker, American Brake Shoe Company, 230 Park Avenue, New York 17, New York.



BRAKE SHOE'S RESEARCH GROUP

1. Engineering Laboratory
2. Metallurgical Laboratory
3. Experimental Foundry

AMERICAN
Brake Shoe
COMPANY

A parts source that may help you meet postwar competition

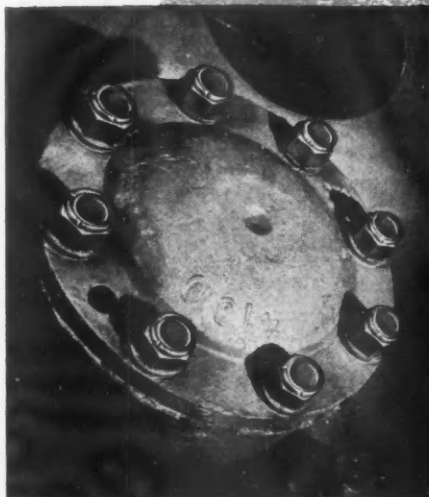
59 PLANTS SERVING INDUSTRY AND TRANSPORTATION

American Brakeblok Division	Detroit, Mich.
Ramapo Ajax Division	New York City
American Manganese Steel Division	Chicago Heights, Ill.
Brake Shoe and Castings Division	New York City

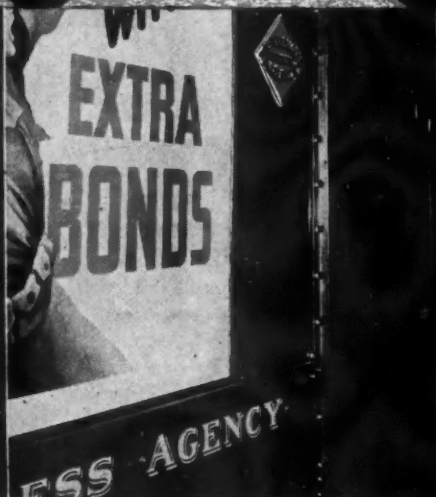
Kellogg Division	Rochester, N. Y.
American Forge Division	Chicago, Ill.
Southern Wheel Division	New York City
National Bearing Metals Corp.	St. Louis, Mo.
Electro-Alloys Company	Elyria, Ohio



HOW TO KEEP 15,000 TRUCKS ON THE GO



These Elastic Stop Nuts are holding the driving flange. Even with frequent starts and stops, and the steady use the wheels of an express truck get, these nuts hold fast.



Railway Express truck bodies are completely fastened with Elastic Stop Nuts. Where other fastenings give with the sway and twist of the truck, these nuts hold tight.



Throughout the chassis, Elastic Stop Nuts are used wherever ordinary nuts loosen in service. Here they are fastening the hand-brake drum on the propeller shaft.

ON the road, trucks earn their keep. In the shop they eat their heads off.

The Railway Express Agency knows that well. And they learned one of the answers to keeping trucks on the go way back in 1927.

They use Elastic Stop Nuts — use them on a great many of their 15,000 trucks.

The reasons? These nuts increase safety and cut down mishaps. They reduce maintenance time and up-keep costs.

Elastic Stop Nuts go on like ordinary nuts. They need no auxiliary locking devices. They can be taken off and put back on time and time again and still lock. Nothing — even severe vibration — shakes them loose.

It's the elastic collar in the top that does the trick. It hugs the bolt threads tight. It cushions vibration. The nut can't shiver loose and turn.

Today billions of these nuts with

the ESNA red collar are being used on our aircraft. A bomber takes as many as 50,000 in a single ship.

In the days to come there will be countless fastening problems on all kinds of products. Perhaps you have one now.

If so, we'd like to talk about it. Our engineers are at your service ready to recommend the right Elastic Stop Nut to provide a safer, surer, trouble-free fastening.

Major spots where Elastic Stop Nuts are at work on Railway Express Agency Trucks

Steering post — fasten bracket to cowl • Steering post — hold bracket to chassis • Drive shaft and universals • Master-brake cylinder to bracket • Hand-brake drum to shaft • Gas tank straps • Propeller shaft center carrier • Clutch and brake pedal brackets • Rear wheel hubs • Motor supports on cross member • Shackle bolt lock pin • Front bumper brackets • Cab bolts • Body hinges • Truck bodies — approximately 375 nuts.





ALUMINUM—Extruded bars. 75.2 square inches per minute cut on the Zephyr.



MAGNESIUM—10" thick. Zephyr cuts 120 square inches per minute.



PLASTICS — BAKELITE $\frac{1}{4}$ " thick, 106 lin. in. per min. SPAULDITE $\frac{1}{4}$ " thick, 82 lin. in. per min. INSUROK (below) 16 sq. in. per min.

Do ALL ZEPHYR

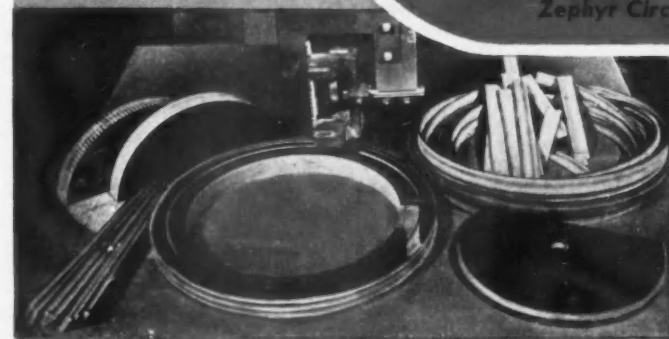
Cutting Speed up to 10,000 F.P.M.

Has cutting and shaping the new light alloys stumped you and your present band saw?

Don't worry—the new DoAll Zephyr was developed especially for these lightweight metals, also for plastics, laminates, plymetals, alloys, wood, etc.

Here's safe, smooth speed up to two miles a minute, supported in a Gibraltar-like housing of welded steel. Equipped with Speedmaster and Job Selector, for quick selection of proper saw and speed for each new job.

Send for interesting illustrated Zephyr Circular today.



WOOD—ROCK MAPLE, 380 sq. in. per min. MAHOGANY 432 sq. in. per min. PREGWOOD, $1\frac{1}{2}$ " thick, 76 sq. in. per min.

Contour Sawing



Band Filer



Super Surface Grinders



Grinding Wheels



Colloidal Cutting Oils



Dust Collectors and Coolant Systems



Variable Speed Pulleys



Band Saws



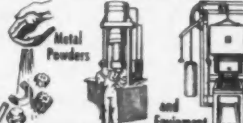
Band Files



Inspection Laboratory GAGE BLOCKS with Instruments



POWDER METALLURGY Metal Powders and Equipment



DoALL

INDUSTRY'S NEW SET OF TOOLS

Write for Literature

CONTINENTAL[®] MACHINES, INC.

1323 South Washington Avenue • Minneapolis 4, Minn.

Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Portland, Rochester, Rockford, St. Louis, San Francisco, Seattle, Toledo, Tulsa, West Hartford.

"Controlled Depth" DeLuxe Oil Cleansing Meets the Filtration Requirements of the New *Detergent Oils*

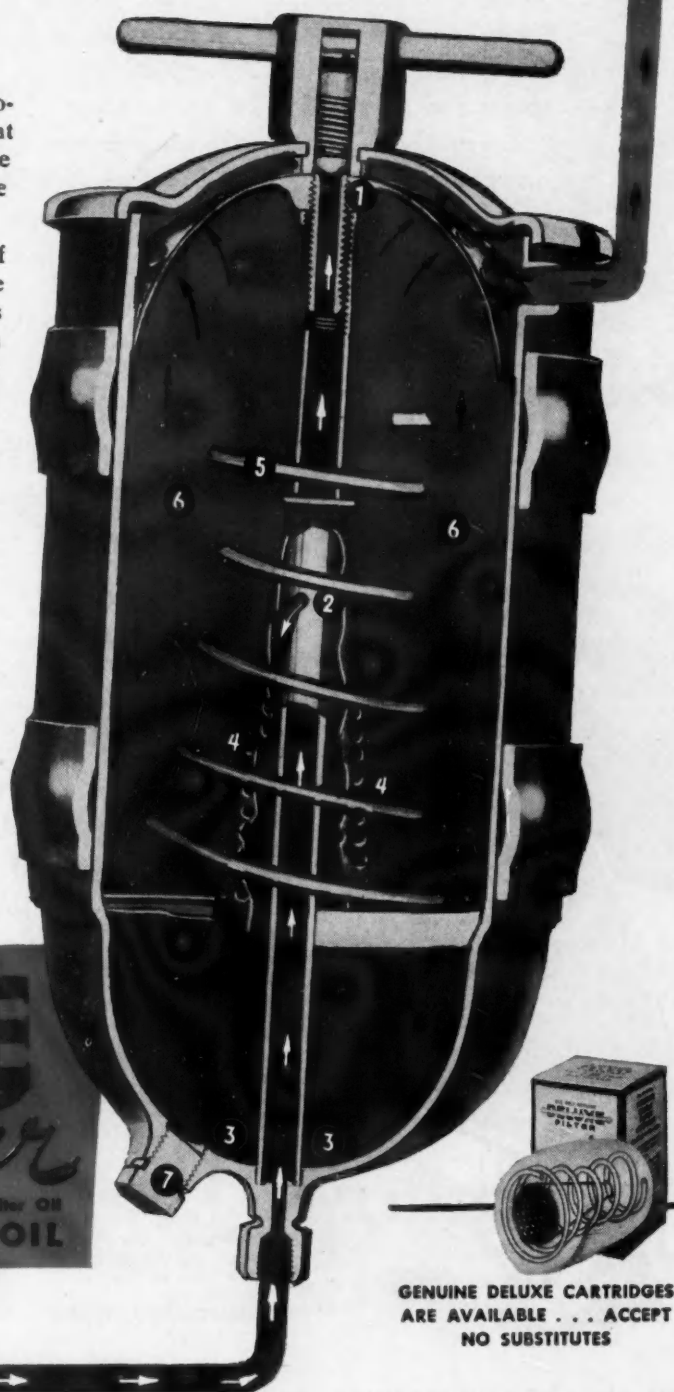
The new detergent oils, the Petroleum Industry's great development in the war against sludge, engine varnish, etc., do not eliminate the need for an oil filter.

They simply make necessary the use of an oil filter which has the capacity to remove much finer particles than heretofore has been required of the conventional type filters which strained out the sludge and other contaminants.

The new detergent oils re-emphasize the importance of the DeLuxe principles of oil cleansing. For regular oil, the Controlled Depth method employed in the DeLuxe Filter removes asphaltenes and other contaminants before they can form into sludge and other formations. For detergent oils, this method provides the Controlled Depth absorption essential to the removal of the minutest particles diffused by the additives without affecting the chemical balance of the oil.

Get ALL the FACTS about DeLuxe. Write for a free copy of "The Key to Clean Lubrication". Your copy will be sent to you without obligation. DeLuxe Products Corp., 1414 Lake Street, LaPorte, Indiana.

DELUXE
Oil Filter
Does More than Strain OIL . . . More than Filter OIL
ACTUALLY CLEANSES OIL



GENUINE DELUXE CARTRIDGES
ARE AVAILABLE . . . ACCEPT
NO SUBSTITUTES

"SHIPYARD SPEED" ON ALL METAL FORMING JOBS

This W-S self-contained hydraulic press is doing an efficient metal forming job in a Navy shipyard where fast production of parts and shapes is vital. In the same way that this press is helping to speed shipbuilding and repair, all W-S metal forming presses will produce fast-forming operations in many metal working plants.



Standing 12 ft. high on floor space of approximately 7 ft. by 5½ ft., this 200-ton single action forming press has a pressing speed of 78 in. per min. with traverse speed of 700 in. per min. Bolster area is 48" x 36"; slide stroke 20"; shut height 16". Driven by 50 h.p. motor.

Watson-Stillman Metal Forming Presses are made in single and double acting types; with and without cushion cylinders. Where cushion cylinders are used they are arranged so that they can provide only a cushion and also obtain separate action if required.

Automatic, electrical single-cycle control equipment, with gauges, auxiliary valve, etc. are panel mounted. Write for complete specifications and details. The Watson-Stillman Co., Roselle, New Jersey.

WATSON-STILLMAN

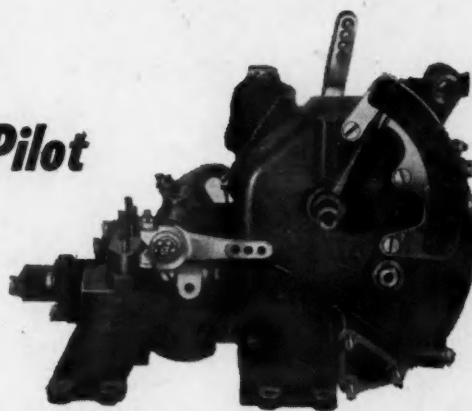
DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT, VALVES, FORGED STEEL FITTINGS



Simmonds *does some planning* *for the busy Feeder Line Pilot*

Current discussions of feeder line systems generally visualize a network of minimum-staffed units. Particularly will feeder line planes require economy of operation. For this reason, any development looking toward the lessening of the pilot's many duties will be a welcome achievement.

Simmonds offers an important contribution with its automatic engine control. Acting as a "third hand" for the pilot, and assuring safer and more efficient engine operation, it provides automatic control of manifold pressure and mixture, maintaining a pre-selected setting through varied altitudes and maneuvers. More advanced designs, made possible by wartime experience and continued research, will extend automatic control to the propeller governor, spark, and other engine functions.



*The Simmonds-Hobson Automatic Engine Control
Mark 46*

SIMMONDS EQUIPMENT FLIES WITH EVERY TYPE OF ALLIED AIRCRAFT

- Automatic Engine Controls
- Push-Pull Controls
- Hydraulic Accumulators
- Hydraulic Fuses
- Chronometric Radiosondes
- Spark Plugs
- Self-Aligning Rod-End Bearings
- Fasteners and Clips of
Specialized Design

SIMMONDS
AEROCCESSORIES INC.

**30 Rockefeller Plaza
New York 20, New York**

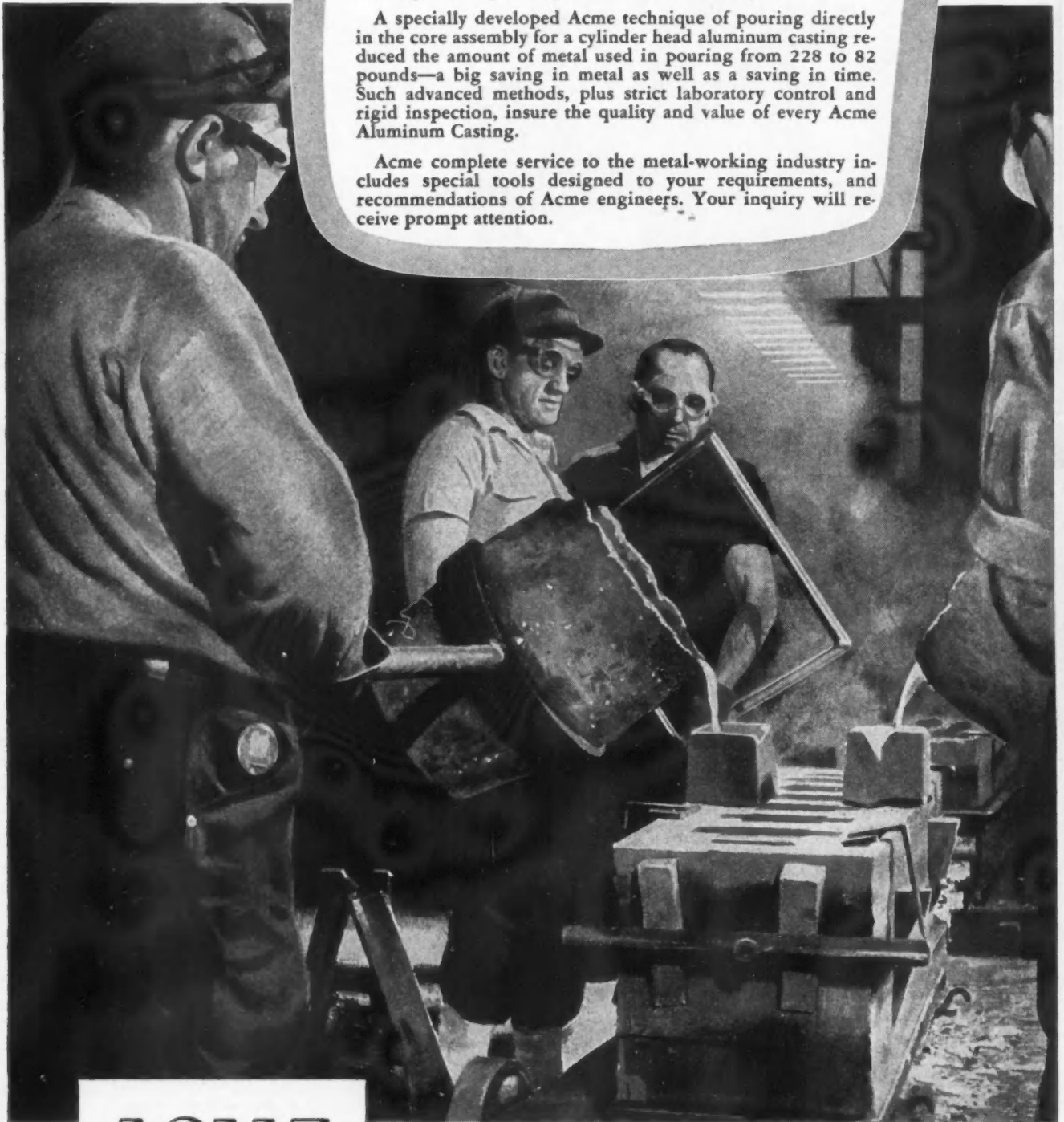
BRANCH OFFICES: DAYTON • WASHINGTON • HOLLYWOOD • MONTREAL

Time Saving Methods Cut Costs of ACME CASTINGS...

These workmen, pouring the core for an aircraft cylinder head aluminum casting, typify the cost-saving skill and precision prevailing throughout the Acme foundry.

A specially developed Acme technique of pouring directly in the core assembly for a cylinder head aluminum casting reduced the amount of metal used in pouring from 228 to 82 pounds—a big saving in metal as well as a saving in time. Such advanced methods, plus strict laboratory control and rigid inspection, insure the quality and value of every Acme Aluminum Casting.

Acme complete service to the metal-working industry includes special tools designed to your requirements, and recommendations of Acme engineers. Your inquiry will receive prompt attention.



ACME

Pattern and Tool Company, Inc.
DAYTON, OHIO

FOR VICTORY
BUY
WAR BONDS
AND STAMPS



HEAT-TREATED ALUMINUM CASTINGS... PATTERNS... TOOLS... TOOL DESIGNING... PRODUCTION PROCESSING

For shooting out the "LIGHTS"...



This Lockheed Transport is a beautiful job. One illustration of the completeness of design is the window "lights" of tough Aero-Quality Lumarith sheets—the high impact strength transparent plastic developed for aviation use. The ports are molded from Lumarith molding materials.

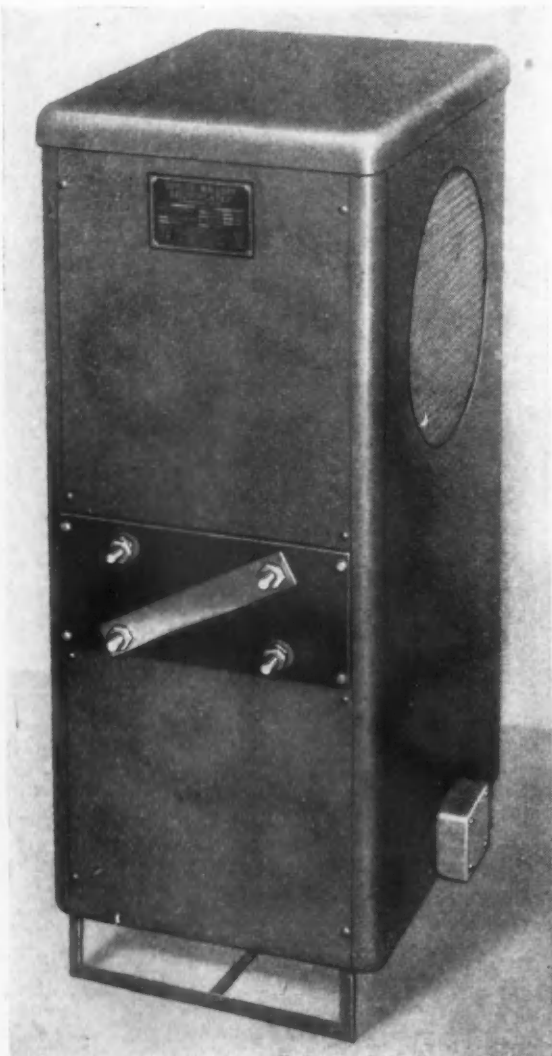
Here is an application that shows Lumarith doing business in two forms. The windows are Aero-Quality Lumarith sheets—the high impact strength transparent plastic developed for aviation use. The ports are molded from Lumarith molding materials.

The general toughness of Lumarith and its ability to withstand torque have strong appeal to aircraft designers. To make full use of this quality, some interesting designs are on the board. If you haven't received a copy of the second edition of Lumarith Mounting book giving data on the

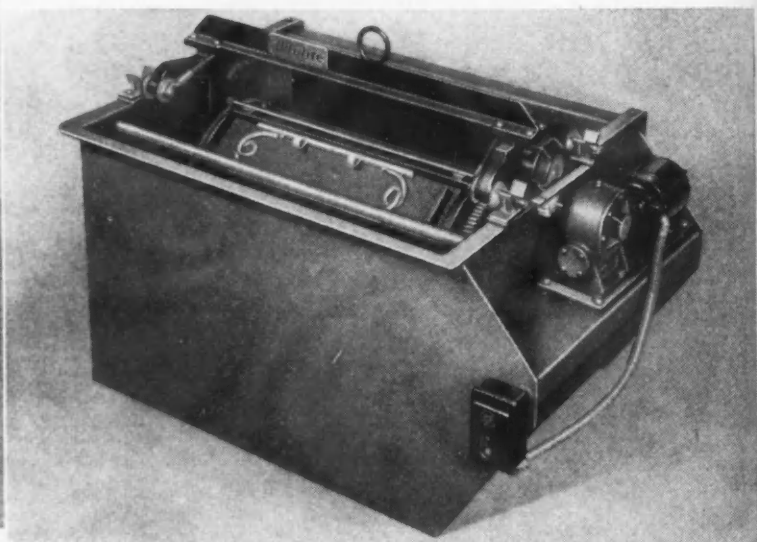
subject, send for a copy. Celanese Celluloid Corporation, The First Name in Plastics, a division of Celanese Corporation of America, 180 Madison Avenue, New York City.

LUMARITH*
A Celanese Plastic*

*Reg. U. S. Pat. Off.



*Forty per cent
less plating
time!*



WITH THE UDYLLITE-MALLORY RECTOPLATER AND THE UDYLLITE BARREL...an "engineered" plating combination

Twelve full volts of plating current, at the tank, all the time. No costly, current robbing bus system. No danger of power sag or burning. Big savings in operating and installation costs. THESE are a few of the advantages of this self-contained, "matched" plating combination.

The increased current density of this combination, plus refinements in design and solution by Udyllite engineers and electrochemists, cut plating time aplenty.

The Rectoplater has long been recognized as THE

compact, economical source of "on the spot" plating current—a unit easily located where needed. Now "matched" by precise mechanical, chemical and electrical engineering with other Udyllite equipment, you have a combination hard to beat.

This is just another example of Udyllite's leadership in the development of finer metal finishing equipment and a better way of doing the job. Udyllite's staff of capable engineers and electro-chemists is at your service. Your inquiries will be efficiently handled.

THE UDYLLITE CORPORATION

1651 E. Grand Blvd., Detroit 11, Mich.

Chicago 12
1943 Walnut Street

Long Island City 1, N. Y.
11-16 44th Drive

Cleveland 3
4408 Carnegie Ave.



BACK TO BASE

on Bower Roller Bearings

'Eyes of the Fleet' bombers, ranging hundreds of miles at sea, get back to base on the unfailing quality of Bower Roller Bearings that carry the rolling load developed by thousands of engine horsepower.

BOWER
ROLLER BEARING CO.
Detroit, Michigan



YOU CAN'T AFFORD TO SHADOWBOX WITH THE PAPER-BOX PROBLEM!

NO, SIR. Or with any other angle of the paper conservation problem. Our boys need every bit of paper and paper board the Army can get to ship their precious invasion supplies in. And it's up to you and every other manufacturer to cut and cut and cut again on the use of paper and paper board.

For every time a convoy sets sail—that's so much more paper and paper board in action. And the supply, as you know, is diminishing.

So your job is to figure every known way, yes, and a few unknown ways, to **USE LESS PAPER AND PAPER BOARD.**

Don't worry about the public, your public, squawking about your cutting down. The big all-out national drive right now is selling the public on the necessity for paper conservation. They'll be with you.

The green light is yours. Step on it.

If your company and your community have not already started paper Conservation Committees, why not get them started now yourself?

USE LESS PAPER BECAUSE

Paper vests have proved excellent for aviators and ground crews as cold protection.

Paper is used for disposable gun covers and ordnance wraps to protect such equipment while making invasion landings.

The Army supplies helmets of laminated fiber for non-combat duty in the tropics.

Many essential airplane parts are fabricated of plastic with a paper base.

Army trucks require 20 pounds of paper for safe delivery.

It takes 25 tons of blueprint paper to make a battleship.

USE LESS PAPER THESE WAYS

Review all printed forms periodically for essentiality; consolidation; elimination of waste space; standardization of sizes, weights, color, grade; elimination of color where possible.

Eliminate carton insert and/or directions when possible and substitute information on label.

Overhanging, extended or padded carton tops should be eliminated unless they can be justified in a critical paper shortage.

Use and re-use carbon paper consistently.

Consider the possibility of reducing the length and increasing the diameter of tubular products as a means of conserving folding and set-up boxes.

Let's All Use Less Paper

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

FASTER PRODUCTION

FOR

Two Worlds!

TODAY

TOMORROW

ARO

PNEUMATIC TOOLS

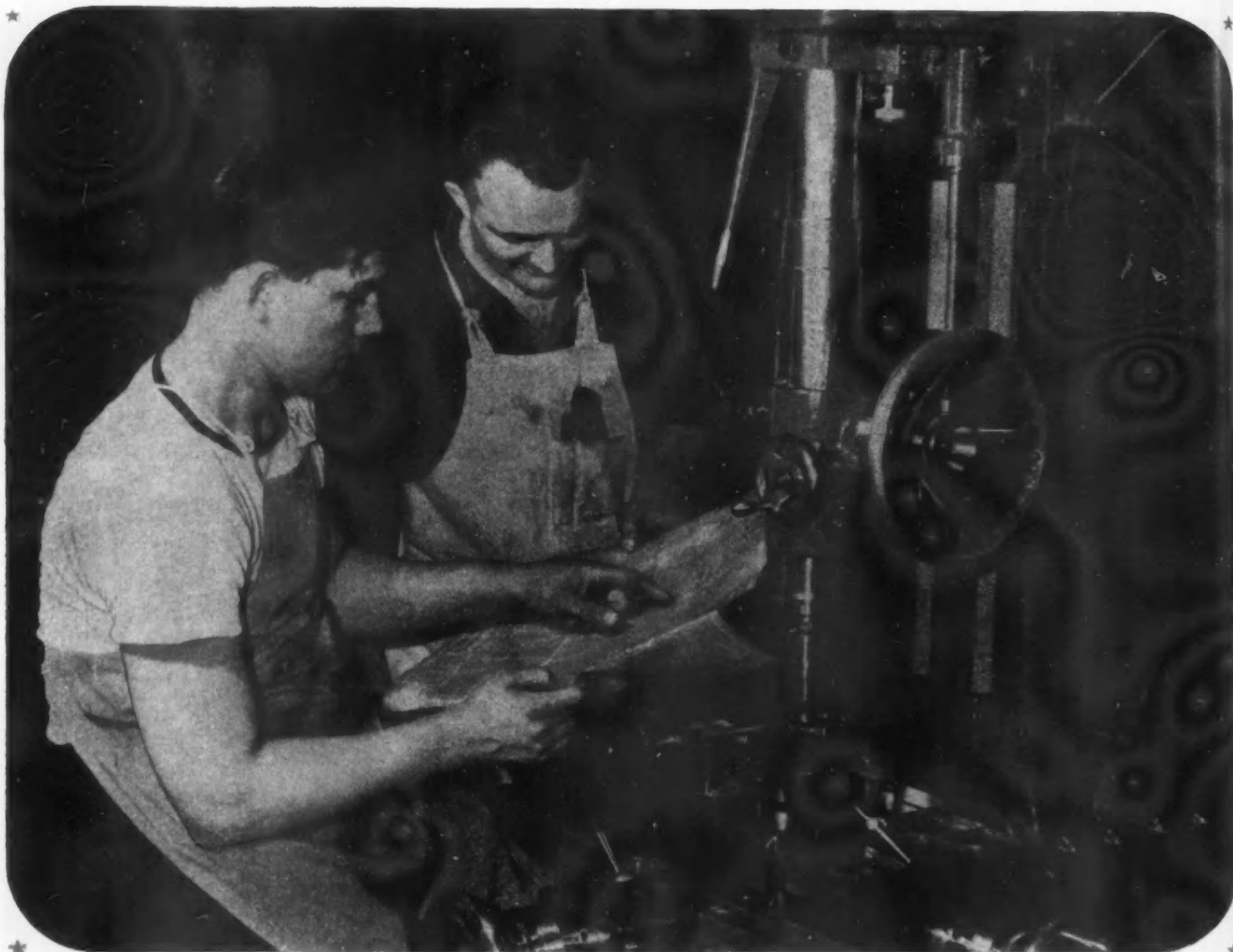
Today—ARO Pneumatic Tools are speeding up small tool jobs for all branches of industry in win-the-war production.

For drilling, grinding, burring, filing, screw-driving, nut-setting and many other small tool operations, ARO Pneumatic Tools get more work done... with less fatigue! They're engineered to furnish more power than average tools of their size—ruggedly constructed—simple in design—stall-proof.

Tomorrow—for peacetime products—ARO will continue delivering Tools for top-speed production! Write... The Aro Equipment Corporation, Bryan, O.

A handful of power in this new ARO model 101 with plastic housing and handle—weighs only 1 lb. 9 oz.—operates full 1/4-inch drill.





**IT'S NOT ONLY *Which* CUTTING MATERIAL
BUT HOW YOU USE IT THAT COUNTS**

**HAND BOOK
OF SPECIAL STEELS**

Newly revised and reprinted—a comprehensive book on the properties, uses, and best methods of handling, treatment, etc. of tool, stainless and other alloy steels. Plenty of tables to facilitate quick reference and selection. 136 pages, pocket-sized, latest data.

**SEND FOR
YOUR COPY**

Address Dept. AI-23



THERE'S hardly a single cutting operation that can't, in some way, be improved. Our record files contain hundreds of instances. Re-design of the tool itself often works wonders. In other cases, a switch of cutting materials shows a marked increase in production, or in pieces between grinds.

That's the job of our Mill Service organization—to work with you for improvement—and the Allegheny Ludlum line now offers you absolutely complete selection. The range extends from Carmet carbide metal blanks and tipped tools—through ALX cast alloy-metal ground bits—to DBL and Super DBL low-tungsten

high speed steels, as well as the various high-tungsten and "moly" types of high speed steels. Call us in, any time, anywhere.



**Allegheny Ludlum
STEEL CORPORATION**

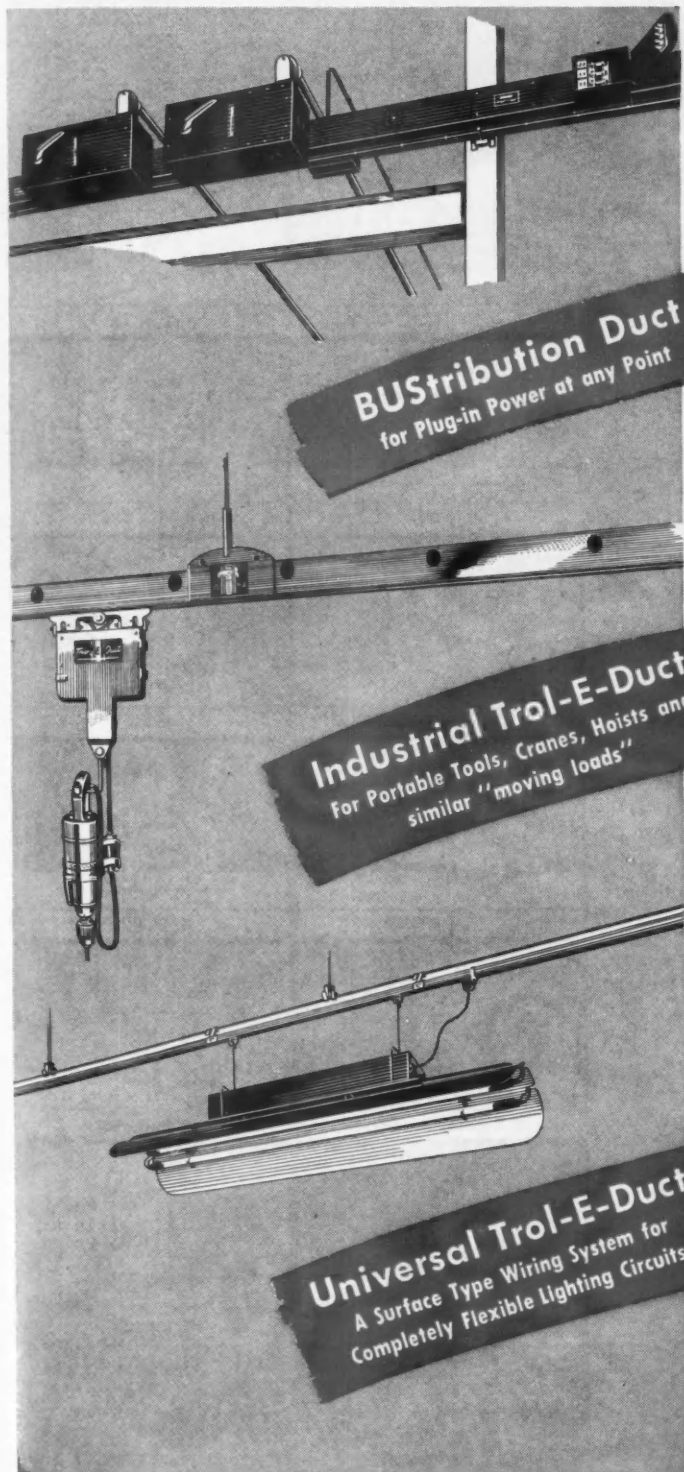
GENERAL OFFICES: BRACKENRIDGE, PENNA.

W&D A-9331

3505 BULLDOG INSTALLATIONS

In America's Largest Manufacturing Plants

WILL SPEED RECONVERSION



BUStrition Duct
for Plug-in Power at any Point

Industrial Trol-E-Duct
for Portable Tools, Cranes, Hoists and
similar "moving loads"

Universal Trol-E-Duct
A Surface Type Wiring System for
Completely Flexible Lighting Circuits

BullDog Duct . . . for power and light . . . will help in Peace Production Race

In thousands of *major* U. S. war plants, new and old, BullDog Electrical Systems have saved countless hours on installation and maintenance — greatly reduced changeover time — helped keep production at top speed and efficiency.

How? By making plug-in power immediately available for any shop set-up. By bringing power close to portable tools on any type of production line. By putting light close to the work on any kind of operation.

An Asset in the Postwar Race

When these BullDog-equipped plants get the go-ahead for reconversion they will again be out in front in the production race — and for the same reasons. Their flexible electric systems will be ready for even the most sweeping changes of product, plant layout or tool set-up.

To manufacturers—large or small—who have not yet installed this modern method of power and light distribution, BullDog offers the services of expert field engineers, to help in planning postwar operations.

Write now for complete descriptive material on BullDog BUStrition DUCT, Universal Trol-E-Duct, Industrial Trol-E-Duct and other BullDog products.

Buy Bonds to the
Limit in the
Fifth War Loan

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of
Canada, Ltd., Toronto, Ont.



Field Engineering Offices in All Principal Cities

ALSO MANUFACTURERS OF
VACU-BREAK SAFETY SWITCHES • SWITCHBOARDS
SAFTOFUSE PANELBOARDS • CIRCUIT MASTER
BREAKERS

Here's a low-cost DE WALT SAW

—you can use for many jobs
anywhere in your plant!



STRAIGHT RIPPING

Here's the latest innovation in wood-working machinery!

DeWalt is the answer to industry's need for a safe, easy-to-operate, adjustable, precision cut-off saw—for use in carpenter maintenance, pattern work, crating and boxing, and production wood cutting.

DeWalt is the ALL-PURPOSE machine that can be changed quickly, as required, from a straight-line cut-off saw—to miter saw—to rip saw—to dado machine—to shaper—or other operations that can be made with circular cutting tools.

No matter how, where or when you cut wood, there's a DeWalt that will reduce your cutting costs, conserve labor, simplify materials handling, save floor space, eliminate waste and actually reduce your investment in the wood-working machinery you require.

Illustrated above is the smallest of our many models. It is available in two sizes complete with motor: ½ HP one phase, AC, \$125.00; ¾ HP three phase, AC, \$135.00. The complete DeWalt line ranges up to 10 HP.

If you're planning to buy a machine—make it a new DeWalt. Mail the coupon below—today!

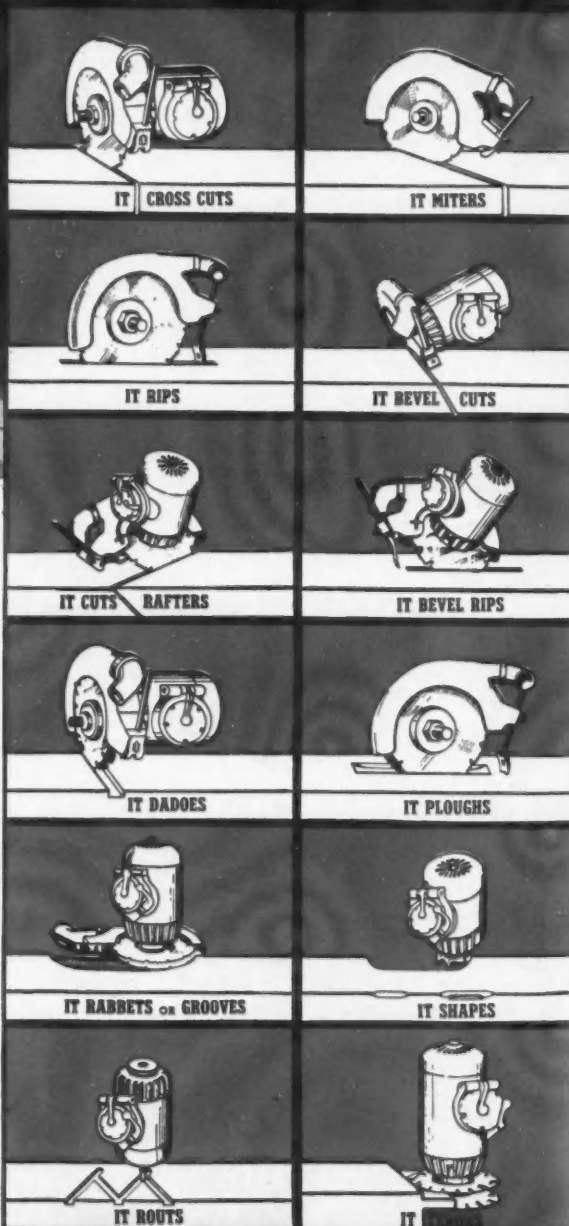
DeWALT PRODUCTS CORPORATION
5802 Fountain Avenue, Lancaster, Penna.

Please send me information on your small DeWalt ☐
Please send me information on your complete line ☐

Address _____

Name _____

City _____ State _____



*Makes Every Cut Possible
With a Circular Saw*

Select

ECONOMY

IN SPACE • WEIGHT • AND HORSEPOWER INPUT

EFFICIENCY

AGAINST PRESSURES RANGING UP TO 7" W. G.

with **AXIAL FLOW FANS**

Recent dispatches from the fighting fronts describe pilots operating at great heights without the use of electrically heated flying suits. Livable temperatures in planes can now be maintained by means of gasoline combustion or exhaust heaters, *with air recirculation through small, light-weight axial flow fans.* In crowded landing ships and small fighting boats, with space at a premium, *axial flow fans provide the air movement.*

These high efficiency units are adaptable to any industrial air movement problem. Standard Dynamic Air Fans, from $4\frac{3}{4}$ " diameter upward, can be modified for special purposes, and deliver air with low power input against blower capacity pressures. Our engineers will put 11 years' experience to work for you. For light weight, small bulk, low cost and efficient air delivery, select Dynamic Air High Pressure Axial Flow Fans.

MARINE
Diam. 5"
Wt. 5 lbs.



MARINE
Diam. 6"
Wt. 6 lbs.



AVIATION
Diam. 6"
Wt. 5 7/8 lbs.



MARINE
Diam. 7"
Wt. 7 1/2 lbs.



AVIATION
6", 2-stage
Wt. 8 lbs.



BUILDERS of HIGH EFFICIENCY AXIAL FLOW EQUIPMENT

DYNAMIC AIR
ENGINEERING
INC.
LOS ANGELES, U. S. A.

HOW TO REVALUE AUTOMATIC MACHINE TOOLS

THERE is only one basis for establishing the present value of any automatic machine—and that is its capacity to produce.

Whether your Acme-Gridley Automatics were bought new for war production, or converted from peace to war work, National Acme suggests a sure way for you to realize their full future value as producers.

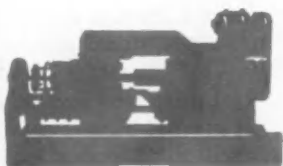
If they need only retooling, have that work done by the same men who designed and set up the original tooling.

If through long service or misuse, they need a complete or partial reconditioning, where can that be done as well as in the shop where they were built, and by the same men?

Acme-Gridleys you might contemplate buying from others deserve the same treatment if you expect these machines to compete in a low-cost market.

National Acme provides these services for the purpose of protecting your investment—at moderate cost. With this goes our guarantee that your reconditioned Acme-Gridley Automatics will be as accurate and as productive as new machines of the same model.

We are ready to talk this over with you.



ACME-GRIDLEY AUTOMATICS
maintain accuracy at the
highest spindle speeds
and fastest feeds modern
cutting tools can withstand.

The **NATIONAL ACME** *Company*
CLEVELAND • OHIO

STOP all leaks

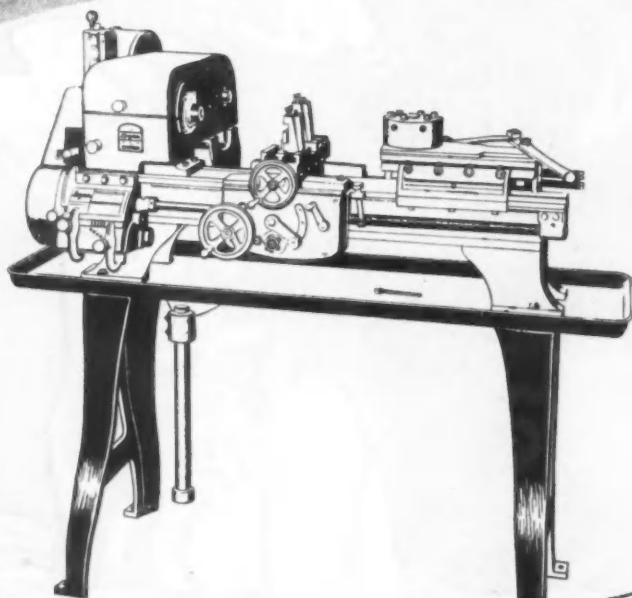


SERVING THE UNITED NATIONS WITH DEPENDABLE GASKETS FOR EVERY APPLICATION

DETROIT GASKET & MFG. COMPANY
DETROIT, MICHIGAN



Logan ACCESSORIES widen THE USE OF *Logan* LATHES



The tooling of Logan Lathes is just as important in obtaining maximum results as having an efficient machine. Logan Accessories are specially constructed with many patented improvements. They are built to the same standards maintained in manufacturing Logan Lathes. When used with Logan Lathes, accuracy is maintained, costs are lowered and output is increased. The various chucking accessories shown here are typical of a wide variety of other accessories that are available. To assure maximum efficiency from a Logan Lathe, ask your dealer or write for the latest Accessory Catalog.



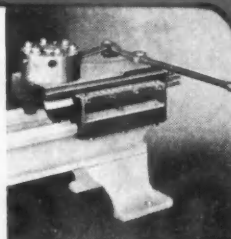
LOGAN ENGINEERING CO.

CHICAGO 30, ILLINOIS

A Name To Remember When You Think of Lathes

LA 40-51 TURRET ASSEMBLY

Six position, self-indexing. Fits bed of any Logan Lathe.



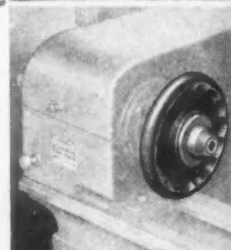
No. AC 210 PRODUCTION COLLET ATTACHMENT

Quick acting, lever type collet closer operates while lathe spindle is in motion. For Push type collets up to $\frac{3}{8}$ "



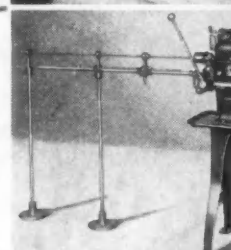
No. AC 201 SPEED COLLET CHUCK

Fits any lathe with $1\frac{1}{2}$ " x 8 thread spindle nose. Minimum overhang assures accuracy. For Push type collets up to $\frac{3}{8}$ ".



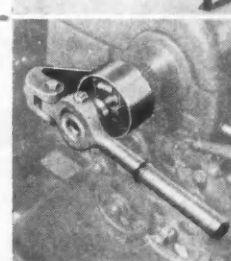
LA 32-34 BAR FEED

For Logan Hand Screw Machines. Uses Push type collets up to $\frac{3}{8}$ " capacity.



No. AC 105 and AC 106 PRODUCTION COLLET ATTACHMENT

Quickly attached to Logan Lathes. Operates while spindle is in motion. For Draw-in Collets up to $\frac{1}{2}$ " capacity.



No. AC 150 and AC 151 DRAW-IN COLLET CHUCK ATTACHMENT

Accurately chucks work between $\frac{1}{16}$ " and $\frac{1}{2}$ " capacity.

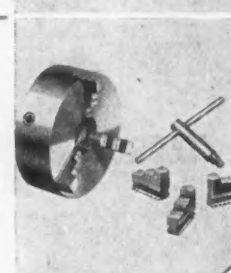


No. 430 3-JAW, 5-INCH UNIVERSAL CHUCK

also

No. 444 6-INCH INDEPENDENT CHUCK

Need no separate back plates. For $1\frac{1}{2}$ " x 8 thread spindles.





"Was my face red!"

HORSE: Mr. Manufacturer, I'm representing Horsepower by Howell. I want to save you trouble, save you time and save you money.

MANUFACTURER: That's a big order. You better be sure of your ground.

HORSE: Exacting, eh? That's the kind of customers we like to sell. You see we build a complete line of standardized motors and we also build special motors for special jobs.

MANUFACTURER: Yes, yes, go on.

HORSE: You know it's much more efficient and economical to get a motor with exactly the electrical and mechanical characteristics required to perform your specific job—

MANUFACTURER: Yes, I know. I am a Howell user—and a Howell booster, too . . . You built my motors more than 10 years ago.

HORSE: Put 'er there, brother, we agree! But don't wait so long to tell me the next time that we see eye to eye on electric motors. The suspense makes my face red. Still, it's gratifying to know that so many shrewd buyers specify Horsepower by Howell and like it.



The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available. *

Available in sizes 5 H.P. and smaller.

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915

Saluting the Capital Fleet of PCA

We congratulate the Pennsylvania Air Lines on the 17 years of service they have rendered America. There is a certain satisfaction, too, in knowing that Flex-O-Tubes had a part in that service record if only a minor one.

The Capital Fleet is equipped with Flex-O-Tubes. Shown here is mechanic Stover installing the Flex-O-Tube that connects the central high pressure hydraulic system with the landing gear brake assembly.



THE

Flex-O-Tube

COMPANY

LAFAYETTE at 14th AVE.,
DETROIT 16, MICHIGAN
Offices: CHICAGO · FORT WORTH
LOS ANGELES · NEW YORK
SEATTLE · TORONTO, ONT.

25 YEARS OF SERVICE



Since 1919 in the oil fields of the world the significance of the Guiberson trade mark has been proved by the saving of millions of dollars in time, in equipment and in increased recovery of oil.

In the tanks of our armored forces it has been proved by the hard-hitting dependable performance of the Guiberson radial diesel engine.

On the skyways of the world it is being proved day after day by the reliability and service of flap track supports, fire walls, motor mounts, manifolds and hundreds of other Guiberson built aircraft parts that are embodied in America's fighters and bombers.

With hydraulic presses, drop hammers, precision machine tools and the south's finest heat-treating facilities Guiberson are meeting the most exacting engineering and manufacturing standards of the world.

After 25 years "Better Be Safe Than Sorry" is today the criterion of precision-built equipment produced in one of America's finest plants.

And when victory is won the Guiberson "G" will carry forward the precision production of products wrought from the metals of the world



ESTABLISHED 1919

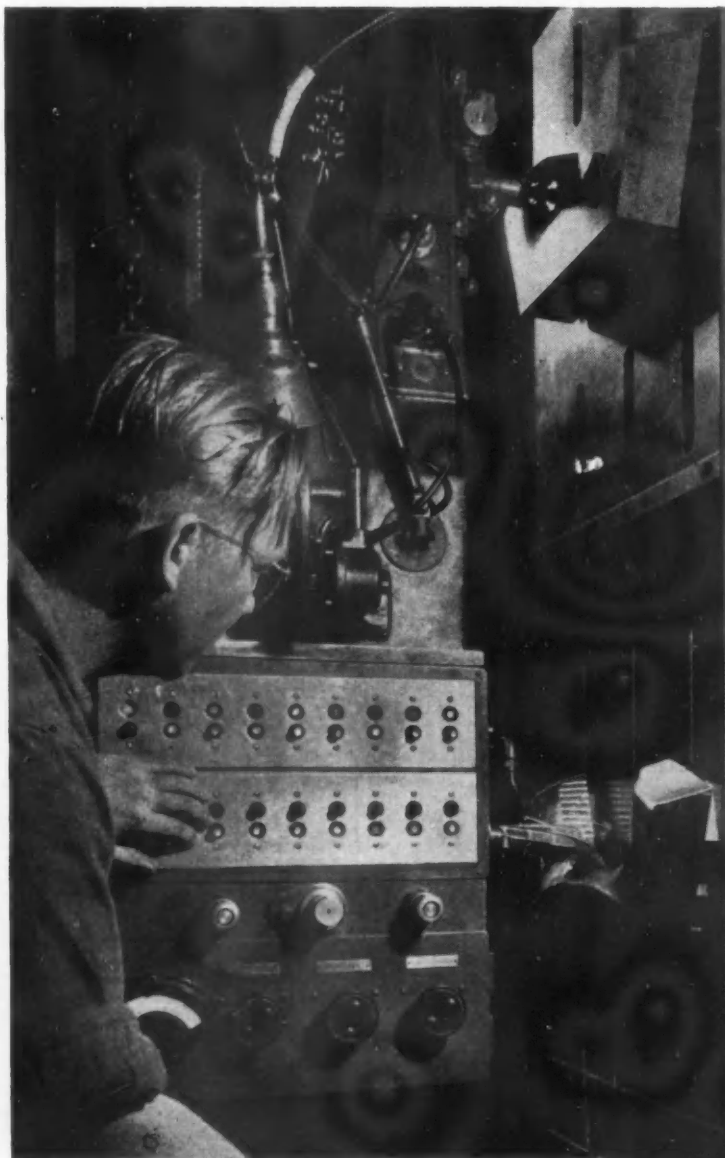
THE GUIBERSON
CORPORATION

Dallas, Texas

GUIBERSON DIESEL
ENGINE COMPANY

"Pre-Converted"

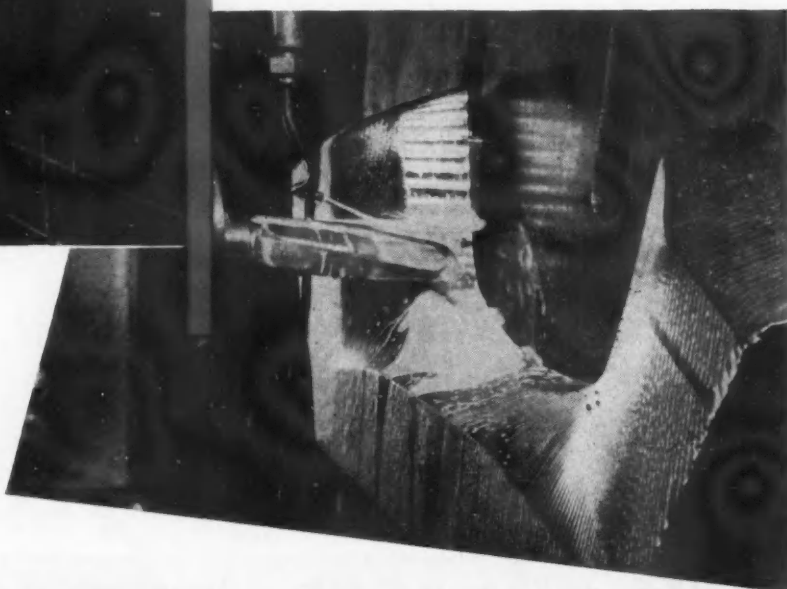
BUT STILL AT WAR



Right — Speeding aircraft production, this Keller is automatically shaping a vital part, as its mechanical-electrical brain follows the template shown at the top of the larger picture. Operator sets up the job with push buttons — the Keller does the rest.

HERE you see the versatile Keller — the machine with the mechanical-electrical brain that was "pre-converted" for peace the day it went to war. With in-built ability to stand the gaff twenty-four hours a day, this Keller is still on its wartime job, speeding aircraft production in one of America's big plants.

But when its war work is over there will still be no rest for the Keller — no time out to be rebuilt or adapted for peace. It was pre-converted to start with, and its "brain" will function with the same speed and dexterity in shaping dies or parts for the postwar products of tomorrow. It will continue to serve the designers, engineers and production men who (soon we hope) will be setting their sights higher than ever in the coming fight to win the peace . . . to produce more and better . . . at the lowest possible cost.



PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD, CONNECTICUT, U. S. A.



Supercharger 1690 MODEL

The hand bellows used by the early settlers and still hanging beside many fireplaces is the grandfather of today's Supercharger. Down through the line of descent—bellows, blower, supercharger—the function has been to force denser air into the combustion zone. In the fireplace "supercharging" burns the wood faster, making a brighter fire; in a diesel's cylinders it burns more oil per piston stroke to deliver greater power.

Compressing the thin air of high altitudes to restore

sea level power to airplane engines is a very effective use of Supercharging. It is equally effective for increasing the power of diesel, gas, or gasoline engines in the "heavy" air most of them have to work in.

Supercharging an engine with more air under pressure than normally drawn in on the suction stroke will burn correspondingly more fuel and will deliver as much as 40% more useful power . . . without appreciable added stress or wear on engine parts.

If you are a manufacturer, let us work with you in designing your engines to permit Supercharging. If you plan to buy engines, ask if they are designed for Supercharging.

Whether the bulldozer goes right through or backs off for a second or third crack at the obstacle may depend on whether its engine is Supercharged.

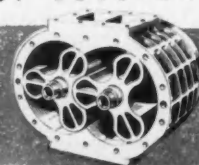


McC

ULLOCH ENGINEERING CORP.
Milwaukee 9 Wis.

DIVISION OF BORG-WARNER

Only two moving parts, precision-fitted, make the McCulloch Supercharger highly efficient and free of maintenance troubles in the field.



Yesterday

and **TODAY!**



WARD ANTENNAS

In the last peacetime year alone, **THE WARD PRODUCTS CORPORATION** made two million antennas. This established **WARD**, by an overwhelming margin, as the leading producer of aerals used by manufacturers of automobiles, radios and portable radios before the war.

Since Pearl Harbor all production has been going to further the war effort. **WARD PRODUCTS** may be found on communication equipment used on all fighting fronts. Men in tanks, planes, command cars, P-T boats—on communication units of all kinds—are becoming familiar with the name **WARD**. . . . When we return to the arts of peace, the superior designing ability, manufacturing knowledge and production efficiency that made **WARD** the leader in the pre-war period and in wartime will be supplemented by knowledge gained from the war effort. There will be new and better products for the post-war period. If your post-war planning includes the use or specifying of antennas, look to **WARD!**



THE WARD PRODUCTS CORPORATION, 1523 E. 45TH STREET, CLEVELAND, OHIO



Battery of "Type D" 16" 6-spindle Mult-Au-Matics machining cylinder barrels for Wright Aeronautical Cyclone Engines. On this job 5 operations are completed in one cycle of 11 minutes.

Planes—Courtesy of U. S. Navy

because of Production Batteries like this

Pictured here is one of the reasons why America is now getting the planes in the overwhelming numbers that we need. Each of these Mult-Au-Matics machines 5 airplane

engine cylinder barrels at once . . . and remember that this battery is * but one of scores like it, many of which are on jobs other than airplane engine work.

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT



PERHAPS the 1000-passenger strato-liner complete with solariums, badminton courts and swimming pool, so glibly pictured by the uninhibited illustrators of the Sunday supplements, will some day sweep through a startled sky.

But we are inclined to believe that the time is still far distant.

In the meantime, our engineering and research staffs are keeping their minds fixed on the pressing problems of the present—and the *immediate* future.

Working shoulder to shoulder with airframe designers and builders, and with engine and parts makers whose tremendous task today is to make America's planes the finest that fly, we are developing new and continually better products

for aircraft use:—*Aircraft quality wire of every type*—stitching wire for the faster, cheaper assembly of parts—hinge-pin wire, strut and tie wire, lock wire, cotter-pin wire—bright finished, tinned or galvanized wire in carbon, alloy and corrosion resisting steels; *TIGER BRAND Control and Structural Cables* that assure perfect functioning of controls; *Springs* of all types and sizes—extension, compression and torsion springs—plane part springs, springs for precision instruments, new and special springs for the plane's fighting armament; *Cold Rolled*

Strip Steel to add strength to airframe and accessory construction; *Cold Finished Bars* of aircraft quality steels, that make possible mass production of high precision parts.

Eminently practical, as nearly perfect as we can make them, these aircraft products have truly earned their wings. Their fine performance in planes that are making aviation history speaks well for our ability not only to take care of today's stiff requirements, but to meet whatever needs the unpredictable future may present.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago

and New York

Columbia Steel Company, San Francisco, Pacific Coast Distributors



United States Steel Export Company, New York

UNITED STATES STEEL



"NO SIR... I'm not tired"

Here he stands, held up by his pride alone. He has hiked 15 miles, part of it on the double quick, with a full pack and his rifle. He has gone over, under and through obstacles. Over the ladders, through mud and water, crawled on his belly under barbed wire. And now, when his commanding officer asks "Are you tired, soldier?, do you know what he has to reply? I'll tell you. He's got to say "No sir, I'm not tired."

So who are we, that we cry out over our daily irritations and concerns? Are we better than this man, and the millions he represents? No! By the living God that made us, we aren't half as good.

★ ★ ★

ATLAS DROP FORGE COMPANY
LANSING 2, MICHIGAN

ATLAS
DROP FORGINGS
FOR WAR

IT IS A DUTY, AN HONOR AND A SAFEGUARD TO BUY U.S. WAR BONDS

Metal SLITTING LINES *by Yoder*



This machine is slitting .091 Alclad in a prominent aircraft manufacturing plant. Sections are made on a Yoder Roll Forming Machine from the smaller coils.

A QUALITY JOB OF SLITTING RESULTS *When...*

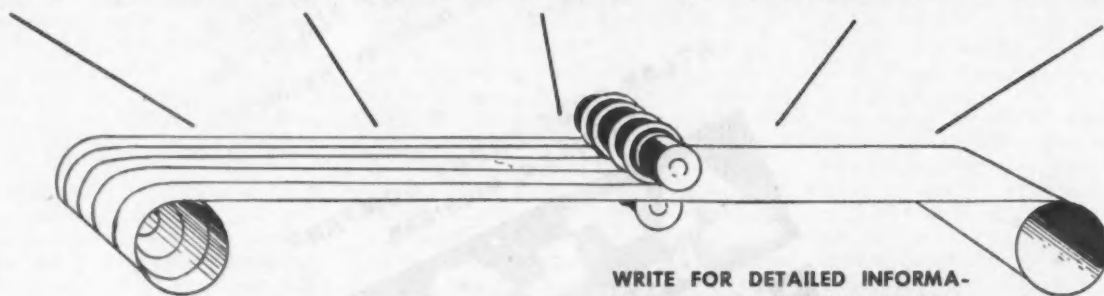
UNLOADING of slit coils is easy.

TENSION can be regulated for cutting and recoiling.

SET-UP can be changed quickly and easily.

OPERATIONS can be finger-tip controlled.

LOADING of coils is simplified.

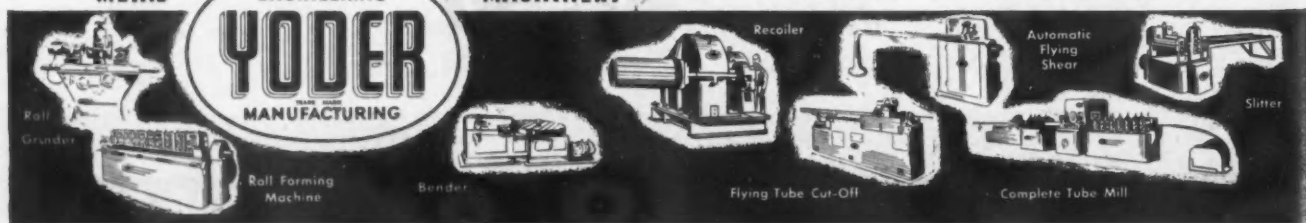


WRITE FOR DETAILED INFORMATION OR OUR GENERAL BULLETIN.

METAL • WORKING • PRODUCTION • ENGINEERING • MACHINERY

THE YODER COMPANY

5500 Walworth Avenue • Cleveland 2, Ohio, U. S. A.



Out where Death Runs the Service Stations



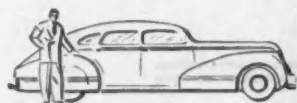
Illustration is from Inland poster showing an operation in the production of the Inland clutch

The Inland clutch is a prewar development by Inland which was standard equipment on many well-known makes of passenger cars and trucks. In war-time this same simplified clutch was quickly adapted to the needs of army trucks and military vehicles. As developed by Inland this clutch has only three moving parts which utilize a single diaphragm spring to perform the function of many coil springs and levers formerly used.

Today, the Inland clutch is one of many parts by Inland which are helping army trucks and military vehicles deliver food, ammunition, fuel and medical supplies to our men on the fighting fronts.

INLAND MANUFACTURING DIVISION
General Motors Corporation, Dayton, Ohio.

Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns and Rubber and Metal Parts for Tanks, Aircraft, Submarine Chasers, Torpedo Boats, Artillery Lighters and Landing Craft.



INLAND

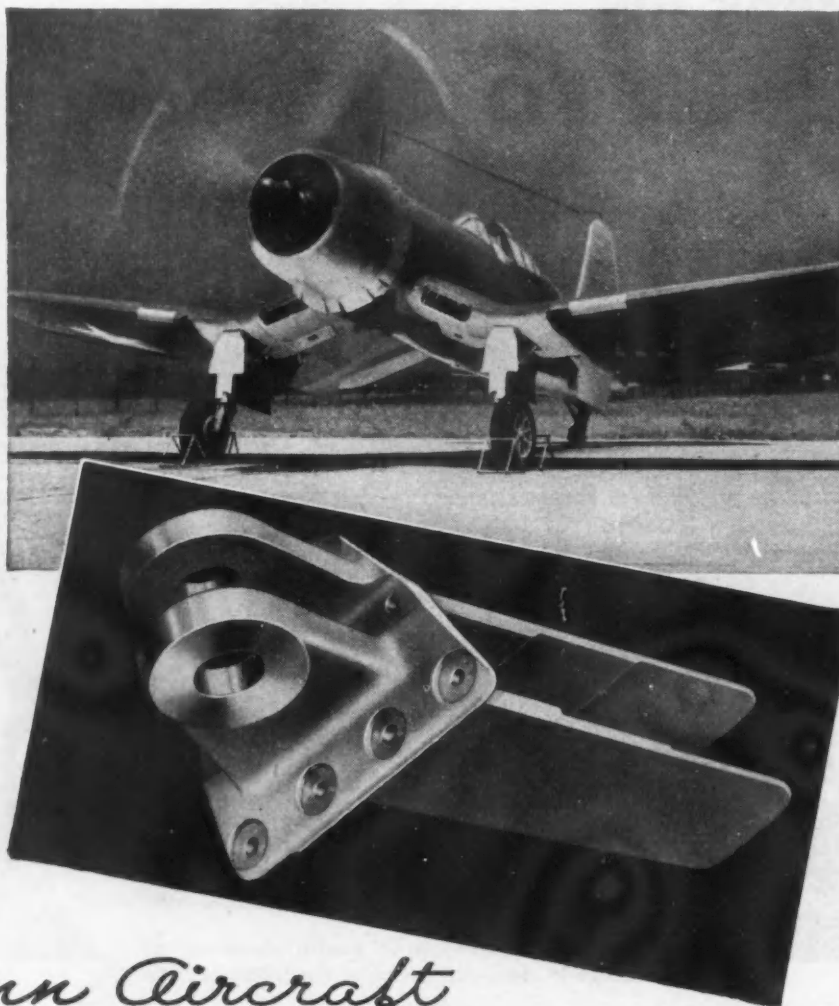


Manufacturing

RUBBER, METAL, PLASTICS

CORSAIR FG-1 Built by Goodyear for the Navy

This famous streamlined fighter has been battle-tested wherever American flyers are engaged. It has the qualities needed for a tough assignment any time — anywhere.



Fenn Aircraft **BUILT PARTS FOR FAMOUS PLANES**

Fenn Plants produce special parts and assemblies for Goodyear and other aircraft manufacturers to rigid specifications. The photograph shows a bulkhead fitting, machined from a solid aluminum forging.

FENN FOR SPECIAL MACHINERY

Today Fenn Plants are wholly engaged in war production, but when peace comes Fenn will once more turn to the design and building of special machinery in which they have majored for three generations. The experience of Fenn engineers and machine builders will be available to industry in the days ahead. If you are thinking of new machinery, or improving old designs for efficient production, why not have a talk with our men? It's time to plan Now.

THE FENN MANUFACTURING CO.
HARTFORD, CONNECTICUT

IT IS NOT
"ALL OVER BUT THE
SHOUTING"

KEEP THAT GUARD UP!



The score in this war is far, far from conclusive. Production, colossal a year ago, must be greater. More ships, planes, tanks — more of all weapons of war — are needed. Anything can happen. We can still lose. Or win. General Machinery Corporation believes in keeping that guard up . . . and we're making the engines, cannon, machine tools for the finish.

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION



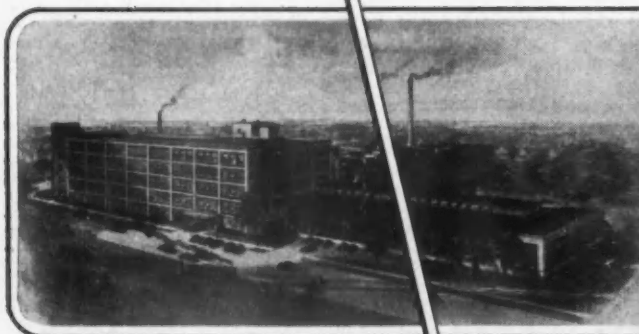


The Tasks of Peace . . . The Preparation For the Demands of War

Before the war, King-Seeley Corporation manufactured precision products in large volume for the automotive and allied industries—such items as gauges, speedometers, interval timers, governors and other comparable units.

The knowledge acquired in time of peace is now devoted to the production of war material for our Armed Forces. King-Seeley Corporation is, and has been, for the past two years, supplying a variety of ammunition components and other war items in ever increasing quantities; items of such nature and in such volume that present production schedules are possible only because of the skill and experience acquired in peace time.

That King-Seeley Corporation has succeeded in meeting and continuing to meet its war production demands in both quantity and quality is attested by the Army-Navy "E" pennant awarded in May, 1942, and which now carries three stars.



**KING-SEELEY
CORPORATION**
ANN ARBOR  MICHIGAN

YOU CAN BUILD FOR THE FUTURE *Today*

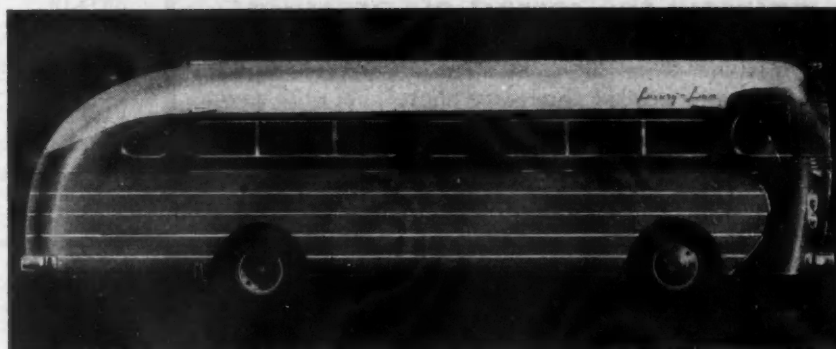


...BY BUILDING *Light* WITH COR-TEN

EVEN before the war, the economic benefits of lightweight construction had been amply proved in the thousands of motor transportation vehicles built of U·S·S COR-TEN. What this COR-TEN equipment has accomplished during these war years has merely emphasized the importance of deadweight reduction as a means of stepping up efficiency.

COR-TEN lightweight buses, trucks, and trailers can carry more payload. They cost less to operate. Require less fuel. Are easier on brakes and tires. Under the heavy loads and high speeds of war service, they have shown amazing ability to stay on the job.

Because steel has the highest elastic stamina of any metal used for weight reduction, this COR-TEN equipment has stood up superbly under road shock, impact and vibra-



tion. Maintenance costs have been consistently low—repairs when needed, simple and easy.

Now that U·S·S COR-TEN is again becoming available for the construction of badly needed transportation units, such as you use or build, get the latest facts about this high-

strength steel. Put COR-TEN to work to make your equipment as modern as you can build it—lighter, stronger, longer lasting, more efficient and more economical to operate.

You'll appreciate these advantages of lightweight COR-TEN construction in the competition that lies ahead.

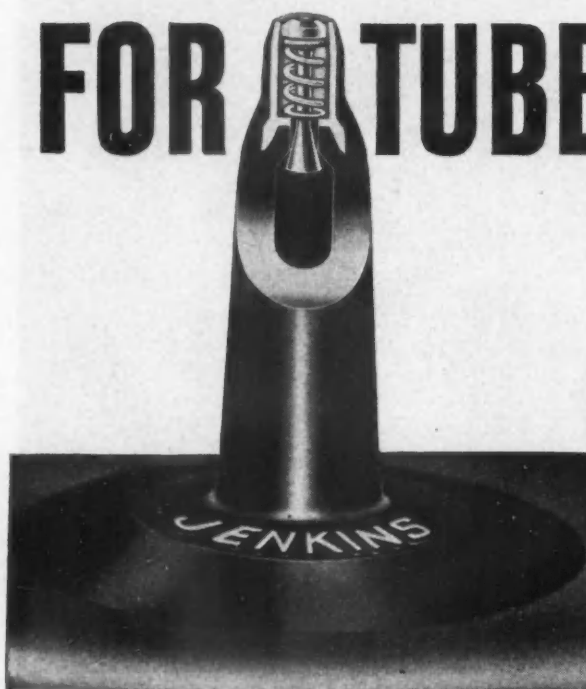
BUY MORE THAN
BEFORE
IN THE FIFTH
WAR LOAN

AMERICAN STEEL & WIRE COMPANY, Cleveland, Chicago and New York
CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh and Chicago
COLUMBIA STEEL COMPANY, San Francisco
NATIONAL TUBE COMPANY, Pittsburgh
TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham
United States Steel Supply Company, Chicago, Warehouse Distributors
United States Steel Export Company, New York



UNITED STATES STEEL

GOOD?-IT'S ***GUARANTEED*** FOR TUBE LIFE!



The JENKINS Tire Valve GUARANTEE

"Every Jenkins Capless Tire Valve is guaranteed Air-Tight for the life of the tube to which it is originally and properly attached."

**Guaranteed Leakproof . . .
because its design needs no cap to
maintain the correct air pressures
that mean longer tire life!**

The plainly worded Guarantee above goes with every Jenkins Capless Tire Valve that goes on an inner tube!

Have you ever seen or heard of another tire valve that carries such an unconditional assurance of dependable service and inbuilt quality? Could you ask for any better evidence of a manufacturer's confidence in his product?

This straightforward Guarantee is a big reason why many car and fleet owners are switching to tubes equipped with Jenkins Capless Tire Valves. At the right are other features of this valve . . . features proved in actual service on millions of tubes. With such a combination of tire- and money-saving advantages, is it any wonder that leading manufacturers are equipping more and more of their tubes with Jenkins Capless Tire Valves . . . and that growing numbers of service men are recommending these tubes to customers? Write Jenkins Bros., Rubber Division, 80 White Street, New York 13, N. Y., for the whole story.

ONLY Tire Valve with ALL these advantages



1.
NO CAP to take off or get lost. Non-removable valve head seals out dirt. Standard size tip takes all threaded or snap-on air chucks.



2.
PERMANENT CORE. Core is integral part of valve . . . can't loosen. Requires no servicing. Stainless steel plug and spring defy corrosion.



3.
PLUG-TYPE SEAT. Long recognized as one of the simplest, surest-sealing valve seat designs. No flat surface to catch dirt.



4.
TRULY FLEXIBLE STEM. No long, rubber-coated metal insert to damage tube or tire in case of flat. Tough, thick walled flexible rubber stem recedes through rim hole gently, safely.

JENKINS *Capless* TIRE VALVE

SEALS AIR IN



SEALS DIRT OUT



MADE BY JENKINS BROS. . . MAKERS OF FAMOUS JENKINS VALVES

For "TOP-NOTCH" welding supplies specify materials!

popular favorites for welding of aircraft parts, jigs, etc.



Airco No. 4 High Tensile Steel Rod

A high test rod that produces welds of high physical properties. Available in 1/16", 3/32", 1/8", 3/16", and 1/4" sizes—36" lengths.

Airco No. 25 Drawn Aluminum Rod

Ideal for welding sheets of the common aluminum alloy compositions. Made in 1/16", 3/32", 1/8", 3/16", and 1/4" sizes—36" lengths.

Airco No. 26 Drawn Silicon-Aluminum Rod

Made of 5% silicon and 95% aluminum, for welding aluminum and silicon-aluminum alloy products. It is particularly adaptable for welding aluminum regardless of composition where parts are held tightly in jigs. Available in 1/16", 3/32", 1/8", 3/16", and 1/4" sizes—36" lengths.

Napolitan Sheet Aluminum Flux

Superior, economical flux for welding sheet aluminum and cast aluminum. Melts at right heat for ideal fluxing action—about 1060° F.

Save buying time—use AIRCO'S illustrated price list of gas and arc welding supplies

This handy booklet gives full details on Airco's comprehensive line of accessories for every gas and arc welding need. Rods, fluxes, brazing alloys, hose, goggles, gloves, and many other welding

essentials are listed with prices, sizes, and shipping details. Mail the coupon for your free copy.

If you also want facts on Airco Electrodes, indicate request for Airco's Electrode Price List.



**Air
Reduction
Sales Co.**

60 E. 42nd St.,
New York 17, N.Y.

Please forward as
soon as possible:

- ☐ Airco Gas and Electric
Supplies Price List.
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★ BUY UNITED STATES WAR BONDS ★



AIR REDUCTION

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Offices in all Principal Cities

Name
Company
Address
City State

Sound the Alert!

MANAGEMENT LABOR

—for the 5th War Loan drive during June and July. The need for the 5th War Loan is immediate, crucial. For impending events may make the 5th the supreme financial effort of the war.

The U. S. Treasury has set the overall goal at \$16,000,000,000 — \$6,000,000,000 from individuals alone. This is the biggest sum ever asked of the American people—and it must be raised.

That's why the U. S. Treasury asks Management and Labor to sit down together and organize—NOW!

For organization—good organization—has been responsible for the excellent showing of the payroll market. And its most important single superiority has been personal solicitation—desk to desk,

bench to bench, machine to machine personal solicitation. 71% of all persons on payroll deductions were solicited for the 4th War Loan.

Now, to personal solicitation, add the sales incentive of a definitely established plant quota. Build your campaign around a quota, plan. Set up departmental goals. Stress percentage of participation figures. Stimulate group enthusiasm.

In planning your quota campaign, work in close cooperation with the Chairman of your War Finance Committee. Everything is set to make the 5th War Loan drive a huge success—with your help!

(Note: You've read this message. If it doesn't apply to you please see that it reaches the one person who can put it in action!)

Here's the Quota Plan:

1. Plant quotas are to be established on the basis of an average \$100 cash (not maturity value) purchase per employee.
2. Regular Payroll Savings deductions made during the drive accounting period will be credited toward the plant quota.
3. 90% of the employees are expected to contribute toward raising the cash quota by buying extra 5th War Loan Bonds: 1—Outright by cash. 2—By extra installment deductions. 3—By extra installment deductions plus cash.

Example: JOHN DOE Mfg. Co. — 1,000 Employees
 1,000 employees x \$100 = \$100,000 Cash Quota
 Regular Payroll deductions during the eight weekly payroll Accounting Periods of June and July = 30,000
 \$70,000 (to be raised by sales of extra Bonds to at least 900 employees)

ORGANIZE

SOLICIT

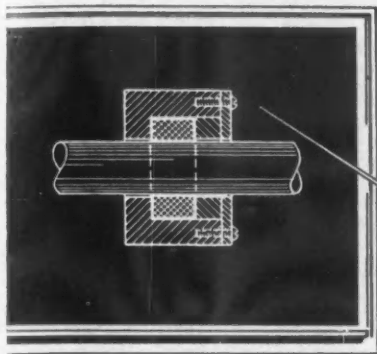
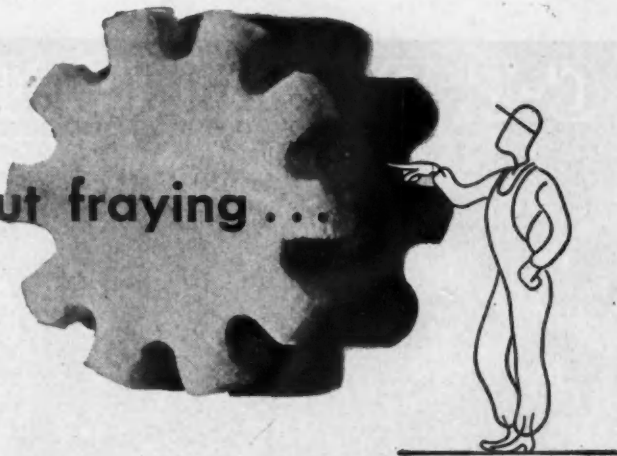
DELIVER



The Treasury Department acknowledges with appreciation the publication of this message

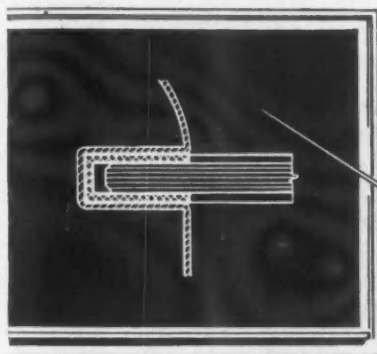
★ ★ This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council. ★ ★

Felters Felt cuts without fraying ...



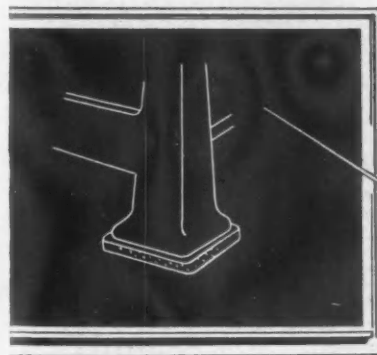
it keeps oil in & dirt out of bearings

Felt lubrication seals—like all Felters cut parts—are cut by our own men from our own designed dies. These lubrication seals are compressible for tight fit, grease absorbent for low friction. Made of hard, tough, fibrous structure for long life.



it keeps the weather out

Because of its lasting resiliency, Felters felt conforms to irregularities, keeps joints tight, *locks out* noise and weather. Used as guides for bus windows, acoustical and thermal insulation for aircraft, and many other applications.



it makes soft-soled shoes for busy feet

Base pads to take the throb out of machine feet—by absorbing and dampening vibrations—can be cut to any shape desired. Felters wide range of consistencies and thicknesses assure proper cushioning for the application. For the complete story on felt cut parts, write for our booklet, "Felt as a Design Material". The Felters Company, 210 R South Street, Boston, Massachusetts.



put



in your post-war picture

C-F POSITIONERS



★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ Faster, Better, Safer Welding ★

★ And more economical, too, with C-F Positioners. Permit downhand welding of top, bottom and sides with a single setup—more uniformly perfect joints, better fillets and beads. Eliminate frequent crane-lifts, save crane-operator and sling crew time. There's a model for every need—from small, hand-operated types to giants that handle 30,000 lb. weldments. C-F Positioners revolve a full 360°, tilt to 135° beyond horizontal. Table rotation from 0 R.P.M. up, for automatic welding. They are universal tools, adjustable for height—pedestal or boom mounted to give maximum floor and working clearance.

★ Write for Bulletin WP-22 ★

★ ★ ★ ★ ★ ★ ★ ★ ★ ★



CULLEN-FRIESTEDT CO.

1322 S. Kilbourn Ave., Chicago 23, Ill.

Rear Engined Tatra Car

(Continued from page 27)

was by engine-driven pump. Around the fuel tank was accommodation for two spare wheels and tires arranged horizontally, one above the other.

Centralized chassis lubrication was provided, a foot-operated pump serving the front wheel swivel pins, front and rear spring connections, steering points, clutch thrust bearing and rear axle bearings in the brake anchor-plate. The specifications called for interior heating of the body by means of hot air taken from a jacket around the left-hand exhaust pipe, but this feature was not fitted to the car acquired by the Nuffield Organization.

As regards the performance characteristics of the Tatra car, it is of interest to quote from an article written by Sir Miles Thomas, who, it may be recalled, is a member of the American Society of Automotive Engineers as well as of the British Institution of Automobile Engineers. The article appeared in *The Autocar* (London), therein Sir Miles put on record, at some length, his opinion of the Tatra car after personal experience as both driver and passenger over a big mileage under a variety of conditions. Here are some extracts:

"The car was magnificent at putting up a high average speed. The relationship between maximum, cruising and average speeds . . . was unusual. This was the result of the extraordinary suspension, the good road-holding and the perfect geometry of the steering. I have driven it at well over 60 mph with two wheels on the road and two on the verge, negotiating curbs and gullies over 8 in. in depth with very little road shock on the steering wheel and only mental, as opposed to physical, discomfort to the passengers. The rear mounting of the engine unquestionably helps suspension, as the overhung mass behind the rear axle has a beneficial effect on overall periodicity and phasing.

"But there were disadvantages, too—very decidedly. I am not a martyr to poor circulation, but I doubt whether I have ever suffered so much from cold feet and ankles as in that car . . . You never realize how useful is even the stray heat given off into an 'engine-in-front' car until you try one like the Tatra. . . .

"In the design of cars that are to sell in quantities, one of the unusual factors that has to be considered is car

sickness. This distressing malady does not afflict everybody, but it is more prevalent, especially among young children, than is usually supposed. It is very difficult to analyze mathematically, because the incidence of meals, stomach acidity and so forth make for wide variations in test subjects. We possess some useful data on the subject, however, to which the Tatra duly contributed, because, in spite of its magnificent road-holding, it definitely had what one of our engineers described feelingly after a fast run as a 'low anti-vomit factor.' . . .

"Another general characteristic of the car was its habit on corners . . . One could wheel round bends with amazing verve. But there was a catch in it.

"If one drives a normal car up to and just over its skid-limit it will start to skid, but will respond to correction if one steers into the skid. With the engine at the rear, however, I found that, although the skid-limit was extraordinarily high, it was very critical and very vicious. The mass at the rear of the car, once it started to skid, tended to keep on coming round to the front, centrifugally, as it were, taking little or no interest in what was being done by the steering and other controls. Having been nearly caught out by this trait on a wet, wide, open main road bend, I took the car to the

Classified Advertisements

MANUFACTURER'S REPRESENTATIVE EXPERIENCED IN PROMOTION AND SALES DESIRES CONTACT WITH INTERESTED MANUFACTURER ANY ARTICLES TO WHOLESALE, JOBBERS, RETAILERS FOR NEW YORK AND EASTERN SEABOARD. 20 YEARS EXPERIENCE. MELAIRE DISTRIBUTING CO., 420 LEXINGTON AVE., NEW YORK 17, N. Y.

WANTED—Two mechanical engineers. Recent graduates interested in development work including design of equipment, construction, and operation of experimental models for problems connected with the war effort. Men are required with initiative and interest in experimental work, plus ability to carry through to successful production. While present problems are war problems, positions available are permanent continuing into postwar work and after. Statement of availability required. Apply Corning Glass Works, Corning, New York.

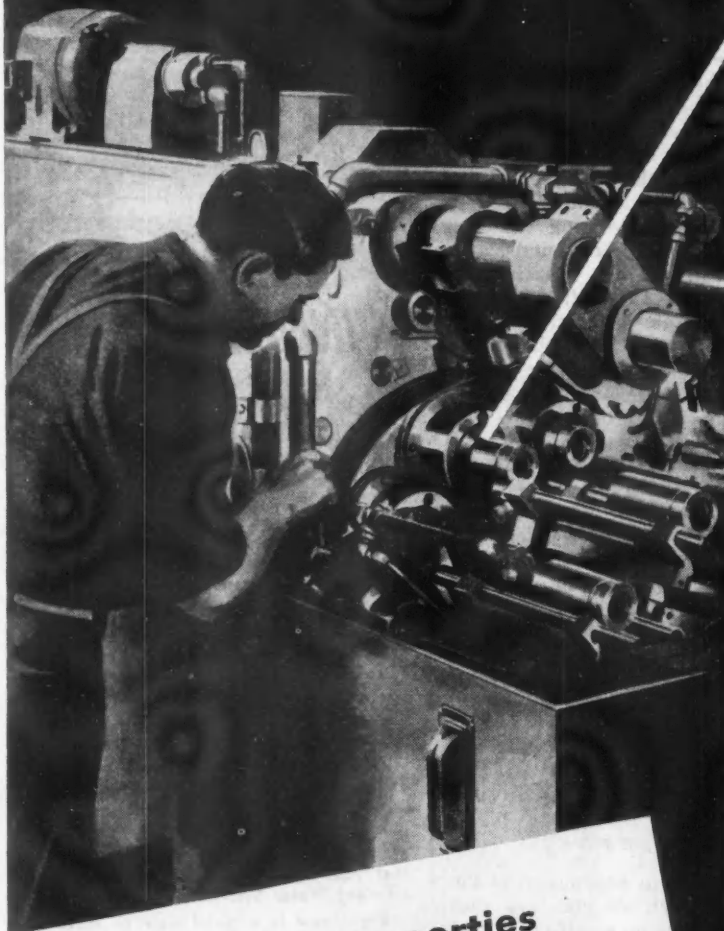
Attention: Samuel Newkirk.

WANTED

AUTOMOTIVE ENGINEER, Designer-Draftsman with ideas and imagination—Motor Truck experience. Promising position with established equipment manufacturer planning whole chassis manufacture. Location N. Y. or Connecticut. Statement of availability required. Write Milford Crane & Machine Co., Milford, Conn.

PLANT EXECUTIVES—Unusual opportunity immediately for experienced operating executives for new ultra-modern malleable castings plant—highly mechanized, large capacity, located in Ohio. Metallurgists and chemists also needed. Permanent positions of responsibility. Write promptly, outlining experience, indicating how soon you can report for work. Statement of availability required. Box 33, Chilton Company, Philadelphia 39, Pa.

Design that part in **ArmaSteel*** and cut machining time as much as 50%



Do These Properties and Qualities Interest You?

Excellent Machinability • Ready response
to selective hardening • Hardenability
comparable to 5040-A steel • Good
fatigue life • Excellent bearing properties
(eliminates need for bushings in many ap-
plications) • Polishes to mirror finish •
Good damping characteristics • Low co-
efficient of thermal expansion.

Widely used to replace plain-carbon and low-alloy steels, ArmaSteel has effected remarkable savings in the production of varied parts for war equipment and pre-war products.

Fundamental savings are two-fold:

1. Compared to forgings and bar stock, ArmaSteel greatly reduces the amount of metal to be removed, since it is cast to conform closely to final shapes.
2. ArmaSteel gives 10% to 50% better machinability, with a 20% to 100% increase in the number of parts finished per tool grind. Experience in the broaching of a particular gun part shows approximately 15,000 pieces obtained per tool grind without the use of a coolant.

Successful applications of ArmaSteel range from gun parts weighing less than a pound, to Diesel locomotive pistons weighing more than 50 pounds. We suggest that you investigate the advantages ArmaSteel may provide in your manufacturing operations.

*Reg. U. S. Pat. Off.

**SAGINAW
MALLEABLE IRON
DIVISION OF
GENERAL MOTORS**
Saginaw, Michigan

★
**DO MORE THAN BEFORE
BUY MORE WAR BONDS**
★

CAST FOR A LEADING ROLE IN INDUSTRY



for de-icing equipment

For years, Mercury has specialized in the production of oil separators for use in connection with the vacuum pump in the de-icing system ... furnishing many thousand units for both Army and Navy aircraft. Especially, if you use oil separator NAF 47089-1, you will be interested in our service on this widely used product.

• aluminum fuel and oil tanks • ailerons, fins, rudders and similar surfaces • aircraft parts and accessories.



artificially greased surface that we use for skid testing, and confirmed the effect. . . .

"As to its other features, the car was obviously at its best on the open main road. For town work it was a nuisance, as the lack of rear vision and the rear overhang made curbside parking a two-man task if there was any reversing to be done. The gear-change was inevitably sloppy, owing to the length of the controls. . . . And the engine was far more noisy as a unit than would be tolerated by modern standards. It had that characteristically loose sound common to multi-cylinder poppet-valve air-cooled engines—the clatter that is damped by the water-cooled cylinders in a normal engine and drowned by the exhaust of an aircraft engine. . . .

"I noticed when driving the Tatra that one was bothered by the shortness of the bonnet and the forward driving position. The effect is not induced by a feeling that one is sitting too close to the accident, as it were, but because one can see the ground whizzing underneath one's feet, so fast and so close. It is, I think, a visual or ocular effect, produced by the far higher angular velocity of the unusually visible portions of the road. A doctor said it tended to produce fatigue. . . .

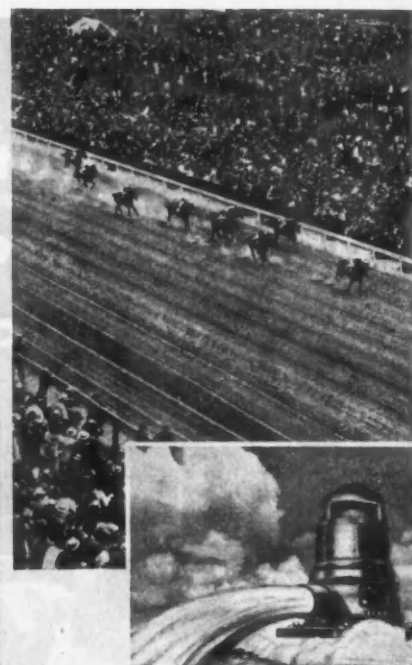
"The sum total of our opinions . . . is that as a piece of unusual automobile engineering the Tatra commanded great respect. . . . But it did not enthuse me with the idea of rear-engined cars as a whole . . . for a good car is not a machine that has one or two brilliantly outstanding characteristics and a host of petty shortcomings. A good car is one that can be said to contain the highest number of usable virtues and the fewest possible vices."

Burgess-Norton Production

(Continued from page 21)

ing phase of B-N pin production is the final finish to which all pins are subjected. This is done on a self-contained battery of four Cincinnati Centerless machines, interconnected by a magazine feed. It consists of a finish-grinder with a 6-in.-wide wheel, a lap-grinder with 24-in.-wide wheels, a lapper with 24-in. wheels, and finally a lapper with 24-in. wheels with variable speed control. The last machine with its variable speed control is the key to the "color" or surface perfection of the pin.

The operation starts with the first grinder, fitted with a Danly hopper feed magazine for loading, then proceeds automatically from one machine to the other to the end of the line. This battery of finishing machines is policed by the inspection department from start to finish. Sizing of the pin in the finish grinder is checked with a large Federal gage having extremely large magnification. Sizing is completed between the finish grinder and the lap-



WINNERS

MUST HAVE QUALITY
... AND ENDURANCE

Maybe you didn't have your money on the winner in the 70th Kentucky Derby! Maybe you couldn't pick a horse like Pensive from a field of 16 starters. But one thing you did know—and have always known—is that it takes quality and endurance to win in any race.

In buying your postwar Water System, you had better remember the quality-endurance formula. You can't afford to own an "also ran" water system when the days of war are over and peace is here again.

You can put your money square on the "nose" of a Layne Water System—and always win. You will win on quality and endurance. You will get large quantities of water at low cost. You will get dependable performance year in and year out. And you will get a mighty big reward in knowing that you own the world's finest and most efficient Water System.

Right now is a good time to make preliminary plans. You can secure the aid of Layne Engineers without obligation. You can get set for the days of peace. Late literature will be helpful. Address Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

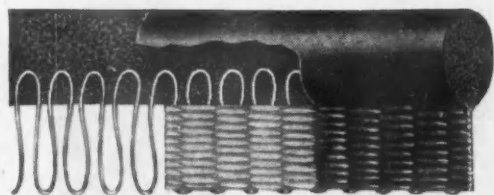
AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne-Central Co., Memphis, Tenn. • Layne-Northern Co., Mishawaka, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northwest Co., Milwaukee, Wis. • Layne-Ohio Co., Columbus, Ohio • Layne-Texas Co., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Western Co. of Minnesota, Minneapolis, Minn. • International Water Supply Ltd., London, Ontario, Canada



**WELL WATER SYSTEMS
DEEP WELL PUMPS**

**BUILDERS OF WELL WATER SYSTEMS
FOR INDUSTRIES AND MUNICIPALITIES**

INNER-SEAL



Established 1837

BRIDGEPORT FABRICS, INC.
BRIDGEPORT CONN.

UPHOLSTERY CLOTH • NARROW FABRICS • ELASTIC WEBBING

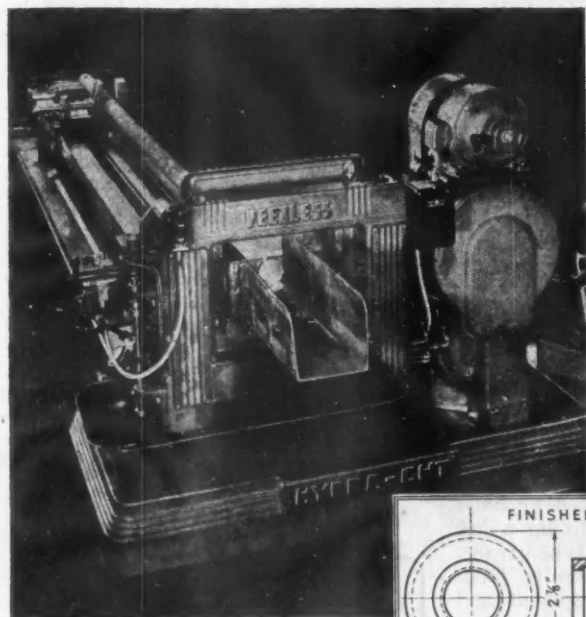
WATERPROOF WEATHER STRIPPING

FOR
PASSENGER
COMFORT

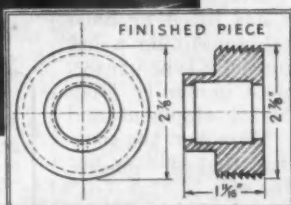
We also supply fire-resistant seat covering—quality upholstery—for transport planes.



Take the Load Off Your Turret Lathes!



By doing the cut-off operation on a precision, Peerless Automatic Saw more finished parts were produced in the Lathe Dept., at less cost.



Peerless Precision Sawing Saves Time, Machines and Men . . .

TO break a "bottle neck," this part made from 3" round x 1335 hot rolled stock, was cut off at the rate of 7 sq. in. per min. in a 7" x 7" Peerless Hydra-Cut Saw.

Smooth, straight-line metal sawing at high speed, with no surface hardening or fracture, is standard performance with Peerless Metal Sawing Machines. Taking as little as 1/16" for the cut, Peerless gives you more usable pieces from each piece of stock. Tell us about your toughest metal sawing operation. Fit Peerless into your postwar plans. Let's see if we can help.

PEERLESS MACHINE COMPANY, Dept. AA-644, Racine, Wis.

- ☐ Mail catalog on Hydra-Cut Saw for High Production Cutting
- ☐ Mail catalog covering Vertical Type used for Die Block Work
- ☐ Mail catalog on Mechanical Type Saw for production cutting
- ☐ Mail catalog on general utility and maintenance Saws

Company _____
Individual _____
Street _____
City _____ State _____





The best "soft" hammers and mallets are rawhide—tough, resilient, long-lasting C/R mechanical rawhide. They strike effective blows without battering or marring... without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.

Write for Catalog Sheets.

CHICAGO Rawhide MFG. CO.
1310 ELSTON AVE. ★ CHICAGO, ILLINOIS

grinder and the product of the latter is checked 100 per cent with the familiar P & W Electrolimit gage which is capable of readings to two-millionths of an inch if desired.

"Color" or surface finish, controlled by the last lapper in the group, is determined by the setting of wheel speed, and this in turn is governed by the surface finish specified by the engine builder. For example, some aircraft pins are held to a finish of two micro-inch on the outside. Incidentally, the inside bore also is held to close surface finish specifications for aircraft pins, some as low as 13 micro-inch.

B-N inspection uses the Profilometer and the Brush Surface Analyzer as normal working tools in its constant control of surface finish. Actually, it is the practice to produce surface finish finer than specified on the drawing so as to avoid rejections due to differences in calibration of the instruments used in production and by the customer. In addition to the other controls employed in aircraft pin production, there is 100 per cent inspection on a special Magna-flux machine, using heavy current density to assure perfection of analysis.

We mentioned earlier the use of the Wheelabrator in the heat-treatment as a means of detecting surface defects. A similar check is made on every pin by the inspection department prior to final finishing. Here the Wheelabrator employs steel shot to provide better color and an easier means of identification of soft spots.

It may be appreciated that the finely colored finish of the pins is susceptible to atmospheric corrosion and extremely sensitive to acid attack during handling by operators. Consequently, care is taken to protect these finely finished parts from the moment they leave the final lapper. To this end, as the pins leave the last machine they are placed in baskets on a gravity roller conveyor, and upon reaching the adjacent dip station, are lowered into a hot dip bath of a rust-inhibiting solution. This serves to remove any residue from the holes or the surface which may have accumulated from the lapping operation. Upon emerging from this bath, the pins enter another station, where they are again dipped—this time in a light rust-inhibiting oil. The pins are now ready for surface inspection and ultimately packing for domestic use or for export.

Following inspection, the pins are pushed along the conveyor to the last station where they are lifted by hoist to the final dip tank containing a hot solution of petroleum jelly type grease. This affords complete immunity from corrosion attack during shipment and while on the shelf. Moreover, the coating is of such nature that it does not harden but will wipe off.

With this background of the process, even though sketched with a wide brush, our readers can appreciate that the seemingly prosaic piston pin is in reality something that depends upon almost every trick of the production art.



RESET IT . . . FORGET IT

Here's how the Watch Dog Fluorescent Starter simplifies lighting maintenance—When a lamp dies the Watch Dog automatically cuts itself out of the circuit stopping annoying blink and flicker. The manual reset button pops up preventing futile and needless starting attempts. Then the maintenance man can replace the burned-out lamp at his convenience. He merely presses in the red button, inserts a new lamp and the lamp immediately begins to operate normally. It's as simple as that. Just reset it and then forget it.

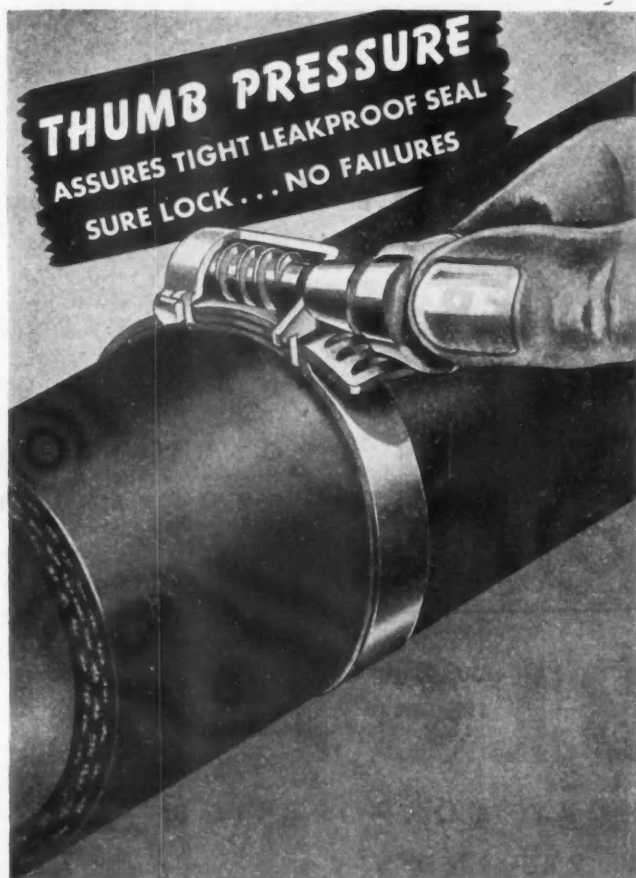


This catalog tells how to use fluorescent accessories for best lighting results. You can obtain your free copy by writing to Section G641-103, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Connecticut.

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC; "The World Today" news every weekday 6:45 P.M. EWT, CBS.

BUY WAR BONDS AND HOLD THEM

GENERAL ELECTRIC



DIAMOND G *Aero Seal* CLAMPS

uniform tightening action for $\frac{1}{4}$ " to 4" I. D.

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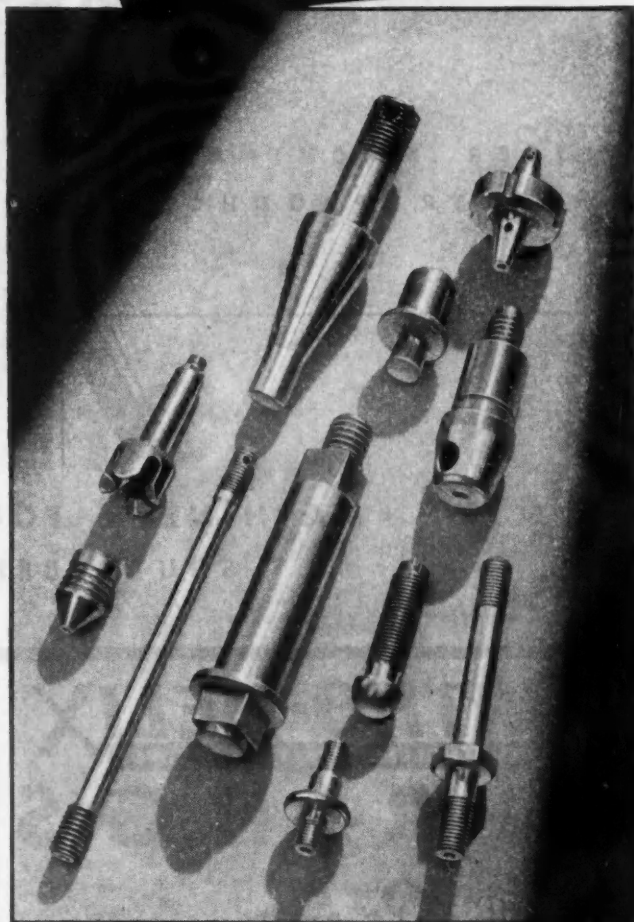
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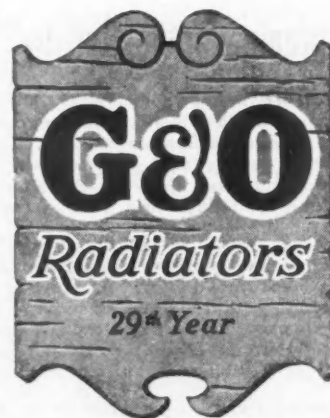
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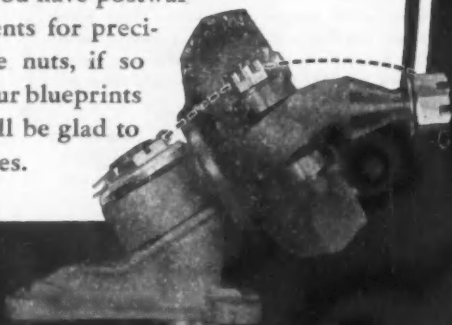
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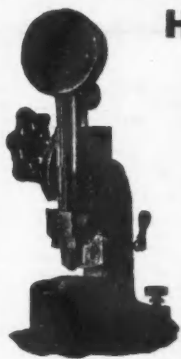
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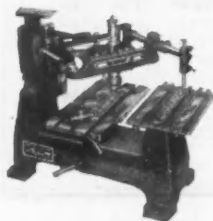




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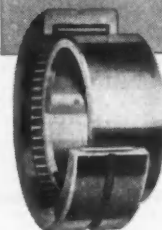
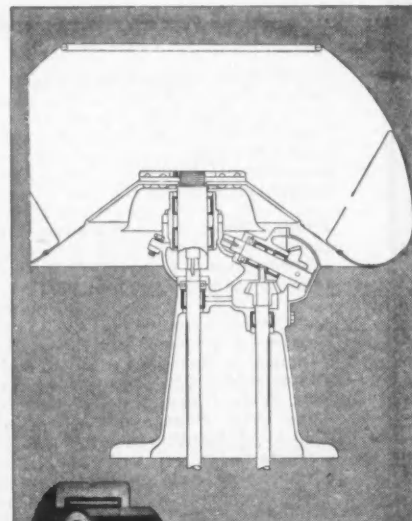
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IN THE NEWS

WITH TORRINGTON BEARINGS

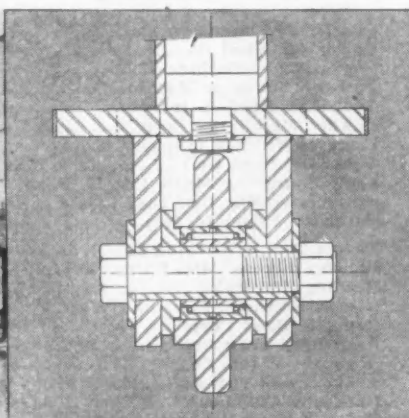
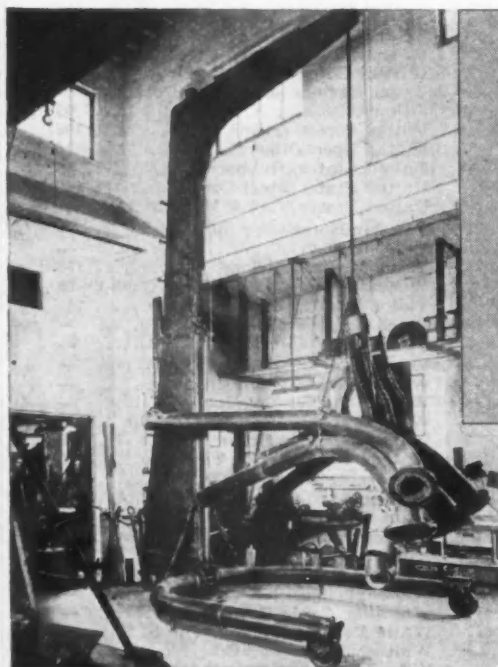


A 95-FOOT "STRETCH" is available through this Hi-Reach Platform Telescope, product of the Economy Engineering Company, used for plane and hangar maintenance by our Army Air Forces. Torrington Type DC Needle Bearings were supplied for the twenty-two hoist mechanism sprocket shafts. These bearings were selected because of their compact design features coupled with extremely high capacity, permitting light but strong construction in the telescoping mechanism.

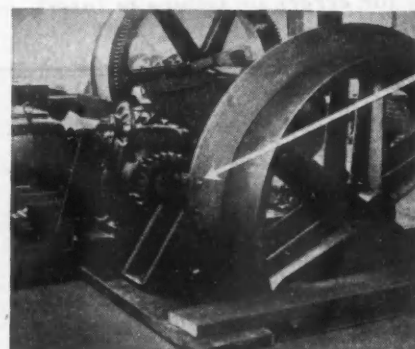


THE DRY CLEANING BUSINESS is at an all-time peak and equipment is being subjected to severe performance tests. Cross-section shows the application of Torrington NCS Needle Bearings in

the pedestal assembly of a dry cleaning unit manufactured by Columbia Appliance Corporation. Now operating almost continuously day after day, these compact anti-friction bearings are demonstrating the advantages of their high capacity and long service life under heavy load conditions.



THIS PORTABLE HYDRAULIC HOIST, manufactured by Federal Aircraft Works primarily for aircraft engines, handles other heavy parts with equal facility. Cross-section shows installation of Torrington Type NCS Needle Bearing in the hydraulic ram sprocket, where it is subject to extremely heavy loads. Its low coefficient of friction is an important factor in contributing to smooth, anti-friction operation.



CAM FOLLOWERS have proven to be an interesting application of Torrington Type RC Needle Bearings in the wire manufacturing machinery of New England Butt Company. They are used to impart a "wobble" motion to the loose fitting ring on the drum of the capstan, the ring guiding the wire so that it "lays" correctly on the drum which revolves at a maximum speed of 125 feet per minute. The high capacity and elimination of stress concentrations of these heavy duty Type RC Torrington Needle Bearings make them ideal for this purpose.

TORRINGTON-BANTAM ENGINEERS, with long experience in the design and manufacture of anti-friction bearings of every major type—tapered roller, straight roller, needle and ball—are in an unusual position to give expert assistance in the design and selection of the correct bearings for any given application. For assistance with today's or tomorrow's bearing problems, TURN TO TORRINGTON.



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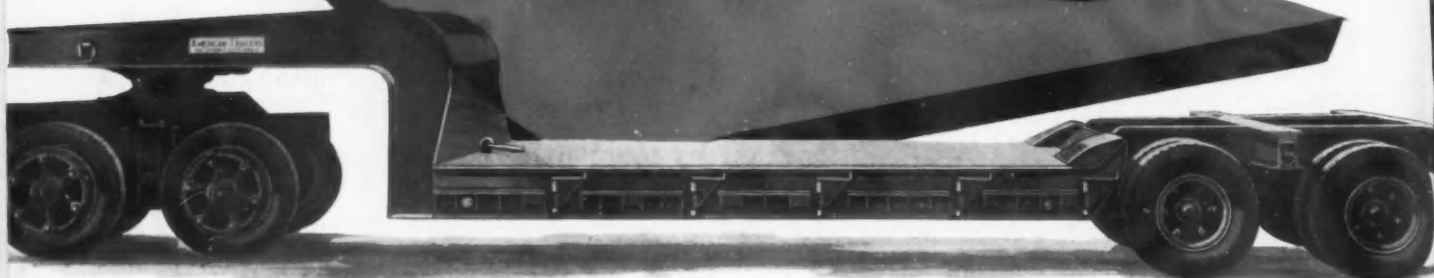
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centage of America's heaviest heavy-duty equipment has rolled on Shulers — and kept on rolling! Naturally we're proud of that record. We're proud, too, that despite all the quality we build into them, Shulers cost no more than ordinary axles. Or, to be more accurate, that they cost *you* no more. . . .

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